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DRAFT
GROUND WATER MONITORING NETWORK EVALUATION
for the
KERR-McGEE CHEMICAL CORPORATION SUPERFUND SITE TRONOX FACILITY SODA SPRINGS, IDAHO

August 1, 2008

Prepared by:

GLOBAL ENVIRONMENTAL TECHNOLOGIES L.L.C.

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GLOBAL ENVIRONMENTAL TECHNOLOGIES L.L.C.

July 28, 2008
Mr. Boyd Schvaneveldt, Site Manager
Tronox Inc.
P.O. Box 478
Soda Springs, Idaho 83276

RE: TRANSMITTAL: DRAFT GROUND WATER MONITORING NETWORK EVALUATION FOR THE KERR-McGEE CHEMICAL CORPORATION SUPERFUND SITE TRONOX FACILITY - SODA SPRINGS, IDAHO

Dear Boyd:

Please find transmitted the Draft ground water monitoring network evaluation. This evaluation fulfills the Task 3.3 deliverable requirements of the final Addendum 1 to the Statement of Work of Remedial Design/Remedial Action Consent Decree for the Kerr-McGee Superfund Site (Addendum 1) from EPA officially dated April 24, 2008. This document is transmitted within the time-critical delivery schedule stated in Section 4.3 of Addendum 1. This evaluation assesses the adequacy of the current monitoring well network.

We appreciate the opportunity to work with you on this project. If you have any questions regarding this transmittal, please contact us.

Very truly yours,
Global Environmental Technologies, LLC

John S. Brown, P.G.
Principal/Owner

Attachments: Work Plan

xc: Matt Paque – Tronox Inc. – Hard Copy
John Hatmaker - Tronox Inc. – Hard Copy
Bill Ryan — EPA Region X – (4 hard copies)
Doug Tanner — IDEQ Pocatello –Hard Copy
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Tom Mosko – CH2M HILL = Hard Copy

DRAFT GROUND WATER MONITORING NETWORK EVALUATION for the KERR-McGEE CHEMICAL CORPORATION SUPERFUND SITE TRONOX FACILITY SODA SPRINGS, IDAHO

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1.0 INTRODUCTION

1.1 General

The U.S. Army Corps. of Engineers (USACE) conducted a second five year review of the Kerr-McGee Chemical Corp. (Soda Springs) Superfund Site in Soda Springs, Idaho in September 2007. This review was conducted for the United States Environmental Protection Agency (US EPA) in June and July 2007. Based on their review, USACE identified several follow-up actions for the site. These actions are discussed in the findings of the Second Five-Year Review Report for Kerr-McGee Chemical Corp. (Soda Springs) Superfund Site (US EPA, September 2007).

The second five year review established that the remedies for the site (i.e. the landfill, calcine cap, and elimination of the liquid pond sources) were completed in accordance with the requirements of the September 1995 Record of Decision (ROD) and the July 2000 ROD amendment. However, a protectiveness determination of the remedy for the second five year review was deferred because levels for some contaminants of concern (COC), primarily vanadium and molybdenum, remained above cleanup goals in ground water and surface water in 2007 in the point of compliance (POC) ground water monitoring wells. USEPA has required additional assessment of the remedy in meeting the cleanup goals since vanadium and molybdenum risk-based concentrations (RBC) currently remain elevated, 10 years after removal of the S-X and scrubber ponds in 1997, and 6 years following capping of the calcine in August 2001.

The purpose of the ground water monitoring network evaluation is to appraise the adequacy current ground water monitoring network. This assessment is done using ground water data results from the Tronox, Monsanto and Evergreen sites for 2007. Results of these investigations are presented in Appendices A, B and C, respectively at the end of this document. This evaluation assesses whether the existing monitor wells are adequately located and can be used to evaluate whether the ground water COC are attenuating rather than migrating in a downgradient direction.

This monitoring well network evaluation is prepared for the Kerr-McGee Chemical Corp. Soda Springs, Idaho Superfund Site as specified in Section 3.3 and 4.3 of the Addendum 1 to the Statement of Work of Remedial Design/Remedial Action Consent Decree for the Kerr-McGee Superfund Site dated April 9, 2008. EPA requested the evaluation of the monitoring well network to establish whether the current network monitored by Tronox defines the offsite migration of site-related COCs from the plant facility boundary and whether monitoring wells that are currently monitored semiannually are adequately located to demonstrate that the COC in ground water are attenuating in the aquifer. This evaluation is one action taken by Tronox to assist EPA in making a protectiveness statement for the site remedy selected in the Record of Decision (ROD) and was completed as described in the work plan submitted on May x, 2008.

1.2 Site Location

The Tronox site (formerly known as the Kerr-McGee Chemical Corporation site) is located in Caribou County, Idaho approximately 1.5 miles north of Soda Springs as shown in Figure 1-1. The Tronox site is on the east side of State Highway 34. The site is bordered by agricultural land on three sides (north, east and south) and by the Monsanto Chemical Company elemental phosphorus plant on the west (on the west side of the highway) as shown on Figure 1-2.

Figure 1-3 shows the location of the monitor wells sited near source areas investigated as part of the remedial investigation (RI). The location of the landfill that was constructed as part of the remedial actions and the lined solvent extraction ponds are also shown on Figure 1-3. Currently, the double lined 10-acre pond is the only remaining pond at the site.

1.3 Site History

Construction of the vanadium production plant facility was completed in the summer of 1963 and full operation began in March 1964. Operation of the vanadium plant continued until January 1999 when the plant was shut down. A number of waste impoundments generated by the plant during vanadium production and the locations of historic abandoned wells are shown on Figure 1-4.

The site was placed on the National Priorities List on October 4, 1989. The effective date of the Consent Order to conduct a remedial investigation and feasibility study (RI/FS) was October 4, 1990. The RI required by the Consent Order was completed in 1995. The Record of Decision was signed in September 1995 and amended in July 2000 to include the capping of the calcine. The feasibility study (FS) for the entire site was completed in 1996 and a supplemental feasibility study for the calcine capping was completed in 2000. The remedial actions for the site that were required for the remedy were completed between 1997 and August 2001. A chronology of site and process changes since the implementation of the Consent Order is shown in Table 1-1.

In 1997 and 1998, Kerr-McGee constructed a fertilizer production plant facility that was intended to process the calcine produced by the vanadium plant and process material from the calcine impoundment on the east side of the plant facility. The fertilizer plant operated intermittently until July 2000 when the plant ceased operation after it was determined by EPA that Kerr-McGee would be unable to reduce the calcine impoundment within a specified 8-year timeframe. The calcine was capped in August 2001 and the fertilizer plant was demolished in 2002 and 2003. The vanadium plant facility was demolished in 2002 and the site surface was covered with limestone fines.

During 2004, Tronox (formerly Kerr-McGee) purchased the Hopkins property to the south of the former industrial facility. This property includes the areas containing the monitoring wells KM-15, KM-16, KM-17, and KM-18, that have been designated the "off-site" wells that are located off of the industrial facility, as established by EPA. The

Tronox facility currently produces lithium-manganese oxide. Production of this material began in 1999. This material is used to produce rechargeable batteries. There are no liquid discharges from the current operations.

1.4 Ground Water COC

The six contaminants of concern (COC) identified in the Risk Assessment (EPA, 1993) include arsenic, manganese, molybdenum, tributyl phosphate, total petroleum hydrocarbons, and vanadium. Table 1-2 presents a range of concentrations for COC at the point of compliance (POC) wells, showing both the largest and the most recent (May 2007) concentrations.

2.0 GROUND WATER MONITORING PROGRAM

2.1 Wells Installed for Remedial Investigation

The existing ground water monitoring network consists of 14 on-site monitor wells, 4 off-site monitor wells and 4 off-site springs shown on Figure 1-3, and listed in Table 2-1. These wells, installed during the RI, have been integral to the investigation and ground water monitoring programs for the site remedy. Investigations made during the RI established that the wells installed to monitor the site prior to the RI shown on Figure 1-4 were not secured, of questionable construction, and did not meet the requirements of the RCRA TEGD for monitoring well installations (Dames & Moore, 1991a). These older wells were abandoned in 1999.

Monitor wells were installed at strategic locations to monitor specific surface water impoundments, aquifer units, downgradient off-site locations, and the Tronox facility as a whole. Locations of on- and off-site well placements and screen location depths are presented in previous technical memoranda and work plans (Dames & Moore, 1991 a, b and 1992) and listed in Table 2-1. Well construction, location and elevation data including specific geologic units monitored is shown in Table 2-2. The monitor wells and surface water sample sites that include Finch Spring, Big Spring and Upper and Lower Ledger Springs are monitored semiannually as required in the RD/RA Consent Decree and the Record of Decision. Sampling occurs at the high and low water periods, semiannually in May and in October.

Locations of all Tronox wells installed during the RI are shown on Figure 1-3. Thirteen of the 18 wells installed during the RI shown on Figure 1-3 are designated "shallow" wells with total depths of 45 to 73 feet. Four wells are designated "intermediate-depth" wells with total depths of 100 to 173 feet. One well (KM-19) is completed on-site to a total depth of 230 feet and designated a "deep" well.

The shallow wells are completed with 10 feet of well screen that is set in the uppermost-defined basalt flow or interflow zone, typically flow Qb5 or interflow zone I4 (Dames & Moore, 1995). Shallow wells were completed within the first occurrence of ground water while drilling. On-site shallow wells include wells KM-1, KM-2, KM-3, KM-4, KM-5, KM-6, KM-7, KM-8, KM-9, and KM-13. Off-site shallow wells include KM-15, KM-16, and KM-17.

The intermediate-depth wells are completed with 20 feet of well screen that is set in a deeper basalt flow identified across the site through geophysical interpretation. These wells are constructed to monitor ground water from a deeper water zone than the shallow wells. On-site intermediate depth wells include KM-10, KM-11, and KM-12. The off-site intermediate-depth well is designated KM-18.

The deep well, KM-19, is constructed near the bottom of the basalt flow and above the Tertiary Salt Lake Formation. The well is constructed with 20 feet of well screen and was completed to monitor ground water at the bottom of the basalt flow.

2.2 Well Location Rationale

Monitor wells were installed during the RI at specific locations to monitor surface impoundments, aquifer units, downgradient off-site locations, and the facility as a whole. Source areas monitored by the monitor wells are summarized in Table 2-1 and shown on Figure 1-3. Rationale for the locations of on- and off-site well placements and screen location depths were reviewed and approved by USEPA based on previous technical memoranda and work plans developed during the RI (Dames & Moore, 1991 a,b, 1992).

Paired monitor wells KM-1 and KM-10 were originally intended to be the upgradient wells for the site and are located north and east of the former vanadium plant. Monitor well KM-1 is a shallow well completed in clay and tuff, whereas well KM-10 is an intermediate depth well completed in basalt. Since the time that these wells were

installed, the two double lined 5-acre ponds were constructed to the north of the monitor wells, and then removed in 2004. The wells are not currently monitored for water quality parameters but are measured on a semiannual basis for depth to water.

Monitor well KM-2 is a shallow monitor well that is completed across the alluvium/basalt contact. This well is located near the southeast corner of the calcine cap. This well was intended to monitor the southern edge of the calcine impoundment area during the RI.

Monitor wells KM-3 (shallow) is completed in clay and tuff and well KM-11 (intermediate depth) is completed in basalt. These paired wells are located south of the former scrubber pond. These wells were intended to monitor the scrubber pond and calcine impoundment area during the RI.

Monitor well KM-4 is a shallow well located to the southwest of the calcine cap and is completed in cinders and tuff. This well was installed during the RI to monitor the calcine impoundment area and downgradient of the scrubber pond.

Monitor well KM-5 is located between the former boiler blow-down pond and former MAP ponds to the west and slightly north of the former vanadium facility. This well was installed to monitor the MAP ponds. Monitor well KM-5 is a shallow well and is completed in vesicular basalt.

Monitor well KM-6 is located south of the former limestone settling ponds and west of the historic landfills. This well was intended to monitor the historic landfills and potential releases to the south from the facility. Monitor well KM-6 is a shallow well with a large hydraulic conductivity and is completed in vesicular basalt.

Monitor well KM-7 is located west of the former vanadium plant and east of the former S-X pond. Monitor well KM-7 is a shallow well that is completed in vesicular basalt and cinders. This monitor well was installed to monitor the ground water on the west side of the former vanadium facility in the vicinity of the west side calcine deposit.

Monitor wells KM-8 (shallow), KM-12 (intermediate depth) and KM-19 (deep) are located to the west of the former S-X pond and were installed to monitor the S-X pond. Monitor well KM-8 is completed in clay and basalt. Monitor well KM-12 is completed in basalt and monitor well KM-19 is completed in clay and fractured basalt at the lowermost sequence of the basalt flows, immediately above the Tertiary Salt Lake Formation.

Monitor well KM-9 is located near the southwest corner of the site facility boundary slightly south of the former S-X pond. Monitor well KM-9 is a shallow well completed in dense vesicular basalt. This monitor well was intended to monitor releases to the southwest from the site and is sited at one of the most downgradient locations from the former vanadium plant and S-X pond.

Monitor well KM-13 is a shallow well located west of the former S-X pond. This well was completed in dense basalt and intended to monitor releases to the west of the S-X pond.

Monitor wells KM-15 (shallow) and KM-18 (intermediate depth) are located south of the site and west of the Finch Spring Fault. Monitor well KM-15 is completed in cinders and basalt and KM-18 is completed in basalt. These paired monitor wells were installed to monitor releases from the site to the south of the site and west of the Finch Spring Fault. Both wells indicate similar COC concentrations.

Monitor well KM-16 is a shallow well that is completed in basalt. This monitor well is located to the south of the site, east of monitor well KM-15 and east of the Finch Spring Fault. This monitor well was installed to monitor releases to the south of the site and east of the Finch Spring Fault.

Monitor well KM-17 is located south of the site to the southwest of monitor wells KM-3 and KM-11. Monitor well KM-17 is a shallow well of relatively low permeability

completed in silt and basalt. This monitor well was installed to monitor releases to the south from the east side of the facility.

2.3 Site Hydrogeology

Ground water beneath and downgradient from the Tronox site is contained within the five basalt sequences identified on site (Qb1 through Qb5a), the basalt interflow zones (I1 through I4), and within limited areas of the alluvium. Ground water also exists within the Tertiary Salt Lake Formation that underlies the basalt, although the Salt Lake Formation does not contain monitoring wells. All of the on-site and off-site monitor wells installed as part of the Kerr-McGee RI/FS are completed at various depths within the basalt and interflow sequences, as shown in Table 2-2. The hydrogeologic properties of the basalts and interflow zones were characterized for the Kerr-McGee RI/FS, using geologic, geophysical, hydraulic head, hydraulic gradient, and hydraulic conductivity parameters from the installed and tested wells. Although ground water occurs in the Salt Lake Formation and within a limited area of the alluvium on-site, the basalts are considered the principal aquifer beneath the Tronox site.

2.3.1 The Salt Lake Formation

The Tertiary Salt Lake Formation is comprised of tuffaceous sandstones, conglomerates and limestones that yield small amounts of ground water for domestic and stock watering purposes, and are unpredictable as a water-supply source. The Salt Lake Formation is not considered part of the shallow ground water system. The Salt Lake Formation was core drilled on-site in corehole CH-3 from 231 to 250 feet (total depth of corehole CH-3) and was found to consist of fractured quartzite, sandstone, and clay with a packer test hydraulic conductivity of 0.77 ft/day. This is within, but at the low end of the range of packer-test hydraulic conductivities estimated for the deeper part of the overlying basalt sequence. No wells at the Tronox site were completed within this formation.

2.3.2 Alluvium

Seismic refraction studies performed as part of the RI indicated that alluvium is thickest and extends to the greatest depth on the eastern side of the plant facility. Based on geologic data from well KM-2, a small area of thin saturated alluvium overlies the basalt in the eastern part of the Tronox facility where the elevation of the basalt/alluvium contact falls below the elevation of the water table. Well KM-2 is screened across the basalt/alluvium contact. The area of saturated alluvium appears to be limited near the east side of the facility, extending a short distance to the north and south of the capped calcine tailings. The alluvium has not been noted to contain ground water at other locations on the Tronox site.

2.3.3 Basalt Aquifer

The basalts and interflow zones of the mid-Pleistocene Blackfoot Lava Field comprise the principal aquifer beneath the Tronox site. All of the on-site Tronox monitor wells, with the exception of well KM-2, are screened exclusively within these basalts and interflow zones. The basalt sequence at the Tronox site, described in the RI is comprised of five identifiable basalt flows (Basalts Nos. Qb_1 through Qb_5) and associated interflow zones (Interflow Zones Nos. I_1 through I_4). Two younger basalts (Qb_{5a} and Qb_{5b}) and associated interflows were identified to the south and west of the site and are believed to have occurred as post-faulting flows. These basalts and interflow zones are believed to be stratigraphically similar to basalt flows identified at the Monsanto Site by Golder (1985 and 1992). However, the hydrogeologic characteristics of the basalt flows between the two sites appear to be different. Notable differences included:

- Magnitudes of hydraulic conductivities of the basalt flows and interflow zones at the Tronox site are similar based on the results of extensive aquifer testing, whereas basalts and interflow units at the Monsanto site are indicated to differ substantially;
- Local water level elevation and water quality differences exist between adjacent shallow, intermediate-depth and deep wells at Monsanto. Water quality and aquifer test data for Tronox indicate that the entire thickness of saturated basalt is in relatively

good vertical hydraulic connection over the area of the Tronox site causing mixing of COC, and;

- Faults are considered to represent zones of increased transmissivity at the Tronox site, whereas they are interpreted to be barriers to flow at the Monsanto site.

2.3.3.1 Hydraulic Conductivities of the Basalt Aquifer

Distribution of the hydraulic conductivity across the site and to the off-site wells is shown on Figure 2-1. This figure illustrates that a zone of greater hydraulic conductivity exists across the central portion of the site in a northeast-southwest trending direction. This zone roughly corresponds with the distribution of manganese, molybdenum and vanadium COC beneath the Tronox property. This zone of large hydraulic conductivity extends from beneath the west half of the calcine cap on the east side of the industrial facility to the southwest towards the Evergreen site and the southeast corner of the Monsanto facility. This zone of larger hydraulic conductivity likely represents a zone of fracturing in the uppermost basalt flow. This zone is bound on the west of the site by basalts with conductivities that are about an order of magnitude less, and by a lower conductivity zone to the south based on the estimates from KM-17. No hydraulic conductivity data are available from the Monsanto or Evergreen sites.

Primary permeability of unbroken basalt is small. Most ground water in basalt is transmitted along secondary features such as joints or fractures. Vertical columnar joints are a common feature observed in basalt exposed to the south and southwest of the site along the trace of the Finch Spring Fault. The presence of intensely fractured or vesicular zones, rubble zones, and/or cinder zones can also greatly increase the ability of basalt to transmit water. Interflow zones are comprised of subaerial deposited materials, including clays, cinderaceous deposits, alluvial sands and gravels, organic debris and weathered and broken basalt. Variations in the ability of interflow zones to transmit water result from changes in the character and thickness of these materials.

Observed hydraulic conductivities estimated from the slug, specific capacity, and pumping tests conducted in the shallow, intermediate-depth, and deep wells include the following:

- Hydraulic conductivity of the basalts ranged from 8 to 340 ft/day.
- Interflow zones hydraulic conductivity ranged from 90 to more than 200 ft/day.
- Basalt No. Qb_5 (shallow basalt represented by shallow well screened zones) hydraulic conductivity ranged from about 9 to 340 ft/day.
- The hydraulic conductivity of basalt No. Qb_3 (Deeper basalt screened in wells KM-10, KM-11, KM-12, and KM-18) ranged from 8 to almost 100 ft/day.
- Hydraulic conductivities estimated for well KM-19 screened in Basalt No. Qb_2 and Interflow Zone No. I_1 ranged from about 15 to almost 70 ft/day.

Generalizations about hydraulic conductivities observed within the basalt aquifer at the Tronox site include the following:

- The hydraulic conductivities of interflow zones are not significantly greater than those of the basalt flows;
- Hydraulic conductivities of the shallower basalts (Basalt No. Qb_5) are generally greater but not significantly greater than those of the deeper basalts (Basalt No. Qb_3);
- A horizontal layer of significantly smaller hydraulic conductivity which could greatly limit or prevent vertical movement of ground water was not identified;
- A continuous horizontal layer of significantly larger hydraulic conductivity along which horizontal ground water flow could be localized was not identified;

2.4 Ground Water Point of Compliance Wells

The Record of Decision (EPA, September 1995) stated that the point of compliance (POC) for the evaluation of the selected remedial actions for ground water will be the boundary of the current active industrial facility, using the existing monitoring wells (EPA, 1995). POC wells include wells KM-2, KM-3, KM-5, KM-8, KM-9, KM-11, KM-12, KM-13, and KM-19. EPA requested the addition of wells KM-2, KM-3 and KM-11 to the list in their May 6, 1997 correspondence and Kerr-McGee included these wells in the

semiannual POC sampling for these wells. Table 2-1 provides the justifications used for sampling of the POC wells at the site, and for sampling off-site well and spring locations.

2.5 Ground Water Sampling Programs

Tronox monitors water levels and water quality in both on- and off-site wells and selected springs shown in Table 2-3 on a semiannual basis, generally in May and October. During the RI (sample rounds 1 through 8, shown in Table 2-1), wells were purged using a submersible pump carried from well to well. The pump was cleaned and purged between wells. Each sample was bailed from the well using a Teflon bailer following the evacuation of 3 casing volumes of water. Rounds 9 through 12 were completed using the same methods although some of the wells were not sampled and the analyte list was modified to remove some analytes that were not detected in the previous sampling rounds.

A ground and surface water sampling plan was developed for the RD/RA sampling events for on-going semiannual sampling. This plan was finalized and accepted by EPA in May 1997. Analytes include the parameters groups shown in Table 2-3 and analytes shown in Table 2-4. Data reports that include the validated data review and the updated RD/RA database are transmitted to the EPA and IDEQ on a semiannual basis. Additionally, a comprehensive ground water report is prepared on an annual basis that presents the findings of the data collection and analysis of changes in ground and surface water quality. The most recent report is attached as Appendix A.

2.5.1 RD/RA Low-Flow Purge Sampling Methods

A low-flow sampling plan was developed during September 1997 to incorporate low-flow sampling methods. Low-flow well purging was first performed during the November 1997 sampling round following dedicated pump installation in each of the sampled wells. Low-flow sampling methods are based on EPA Region 1 "Low Flow SOP" dated

May 13, 1996 and the EPA document "Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures" dated April 1996. This method was provided as an addendum to the RD/RA Sampling and Analysis Plan (SAP) deliverable submitted to EPA during May 1997 and approved by Region 10 EPA on June 6, 1997. Low-flow sampling is performed on all of the "KM" series wells with the exception of non-POC wells KM-1 and KM-10. Wells KM-1 and KM-10 are monitored for water level purposes only.

Stainless steel submersible pumps were installed in most of the monitor wells during October 1997. A pump was installed in KM-7 during May 2000. The pumps are dedicated for evacuation and sampling purposes. Each pump is operated by a portable generator. Each pump is suspended on Schedule 80 1-inch PVC piping and a stainless steel safety cable (in intermediate depth and deep wells), such that the intake level on each pump is placed in the approximate center of the well screened interval. During sampling, flow rates are measured concurrent with drawdown in each well to assess stabilization of purged ground water. A discharge assembly is used to control the rate of discharge from each well via use of a ball valve. The assembly is used to control discharge from each well during sampling such that the amount of discharge will not allow the well to be drawn down more than 0.3 feet during purging and sampling events.

Field measurements are made through the use of a turbidity meter and flow cell. The flow cell is used to measure pH, temperature, specific conductance, and dissolved oxygen. Field data are graphed following sample collection to show stabilization of field parameter measurements with time prior to sample collection. These graphs are presented with the semiannual data validation reports. Criteria used to determine whether the purged water has stabilized include:

- pH within ± 0.3 units;
- Temperature to within ± 2 degrees;
- Specific Conductance within ± 10 percent;
- Dissolved oxygen within ± 10 percent, and;
- Turbidity within ± 10 percent.

If the parameters do not meet the above criteria within the extraction of three casing volumes of water, then a sample is obtained following the removal of not more than three casing volumes of water. Samples are collected from the discharge point beyond the ball valve. Samples are collected and handled in accordance with the May 1997 SAP.

2.5.2 Monsanto Ground Water Monitoring Program

Ground water sampling is performed for the Monsanto site on an annual basis. Results from the ground water sampling round completed at the Monsanto site in 2007 are attached as Appendix B to this report. Between June 19 and June 25, 2007, Golder collected groundwater measurements and samples per the annual sample collection requirements of the Monsanto ROD. Wells were purged using dedicated pumps in most of the wells. Samples were obtained following the purge of three casing volumes. The samples collected in June 2007 were shipped to SVL Analytical in Kellogg, Idaho under chain of custody for analysis. The analyte list used for the Monsanto site in 2007 included molybdenum, vanadium and manganese. Of particular interest to the Kerr-McGee Superfund site are the Monsanto monitor wells that are placed along the eastern edge border the of the Monsanto site, including TW-33, TW-38 and TW-12. Wells TW-56 and the Lewis Well that are also monitored by Monsanto define the western extent of COC impacts to ground water from the site. Ground water investigations made during the RI concluded that these wells are most influenced by the off-site migration of COC (Dames & Moore, 1995).

2.5.3 Evergreen Ground Water Monitoring Program

Ground water sampling is performed for the Evergreen site by Sprague Environmental LLC (Appendix C). Four wells were installed and sampling commenced in November 2003. The most recent sampling round from Evergreen was in May 2007. This round was completed close to the time of sampling at the Tronox site in May 2007. The analyte list used for the Evergreen site included COC molybdenum, vanadium and

manganese. Each Evergreen monitor well was sampled using a clean Teflon bailer. The depth to ground water was measured and at least three casing volumes of water were removed using a clean Teflon bailer prior to collecting the samples. When the sample bottles were filled the temperature, pH and conductivity of the ground water was measured in the field. This information was recorded on a field sampling form for each well. The sample bottles were sent to ACZ Laboratories in Steamboat Springs, Colorado under chain of custody for analysis.

3.0 GROUND AND SURFACE WATER DATA EVALUATION

Ground water monitoring water level and analytical data obtained from the Tronox, Monsanto and Evergreen sites in 2007 will be used in the following subsections to demonstrate that the existing monitoring well network is adequately placed to assess the movement of COC off site.

3.1 Ground Water Elevations and Flow Direction

Figure 3-1 presents measured water level elevations and ground water gradients in May 2007. This figure includes water levels obtained by Golder for the Monsanto site between June 19 and June 27, 2007 (Appendix B) and from Sprague Environmental LLC for the Evergreen site (Appendix C), obtained in May 2007.

Ground water flows in response to hydraulic gradients from areas of higher hydraulic head to areas of lower hydraulic head at rates that are proportional to hydraulic conductivity and hydraulic gradient and inversely proportional to effective porosity of the aquifer. Ground water mixes vertically through much of the basalt aquifer across the Tronox site in response to vertical hydraulic gradients such as those noted in KM-15 and KM-18 and horizontally within aquifers in response to horizontal gradients as is demonstrated between the wells. Ground water in the regional Shallow Aquifer System flows southward from the topographically higher Blackfoot Reservoir (about 12 miles north of the Tronox facility) to seeps and springs along the topographically lower Bear River.

In the vicinity of the Tronox facility, horizontal hydraulic gradients and ground water flow directions within the shallow basalt units during May 2007 are indicated by water level elevations contoured on Figure 3-1. The on-site hydraulic gradient averaged about 0.02 ft/ft in 2007, although the gradient is flatter on the east side of the site beneath the calcine cap.

Instead of flowing south as the regional aquifer does, much of the ground water flow in the aquifer beneath the Tronox site is to the west and captured by Monsanto's production wells PW-1 through PW-4. The predominant flow direction beneath the plant site is to the west-southwesterly towards Monsanto, as shown on Figure 3-1. Ground water levels on the Monsanto site are shown on Figures 6 and 7 in Appendix B. Because Monsanto pumping wells are downgradient from the Tronox site, some of the mass of COC from the Tronox site are captured by these production wells. Monsanto ground water elevations for June 2007 show that capture zone for the production wells is the upgradient area above 5890 foot porentiometric level (Figure 5, Appendix B).

Ground water levels beneath the east side of the facility indicate a more southerly flow component, immediately to the south of the calcine cap, based on nearly identical ground water elevations observed in wells KM-2 and KM-3, as shown on Figure 3-1. This flow direction and gradient is virtually unchanged since first evaluated in November 1992. Flow rates from these Monsanto production wells PW-1 through PW-4 were reported to be in the range of 1200 gpm (Dames & Moore, 1995) during the RI.

Water level elevations measured during May 2007 in the intermediate depth monitor wells KM-11, KM-12, and KM-18 are also shown on Figure 3-1 but are not considered in the contouring. Ground water levels in the intermediate depth wells indicate a pattern of ground water flow that is similar to the pattern observed in the shallow wells.

3.2 Site Water Levels and Site Precipitation

Figure 3-2 presents annual precipitation totals for Soda Springs, Idaho between 1990 and 2007, obtained from Tigert Airport in Soda Springs. Annual totals peaked at about 17.5 inches in 1994 and 1997. Annual precipitation rates declined after 1997 to about 11.5 inches in 2001. Annual precipitation rates have been increasing on average since 2001, to just over 15 inches annual average in 2006. However, 2007 ended up with less than 10 inches of total moisture.

Site ground water level changes over time correlate with variation in the annual average precipitation rates. However, general rises in site ground water levels lag the precipitation by about three years, based on the observation of the low annual average in 2001 and recovery in water levels in site wells after 2004. Overall, ground water elevations dropped on average 5 to 8 feet between 1997 and October 2001, and then remained at lowered levels in the fall through 2004, as indicated on Figures 3-3 through 3-5. Ground water elevations recovered several feet between 2004 and 2007, towards the range of levels observed in 1997. This recovery is noted to occur at the same time as increased COC concentrations in a few wells, including KM-6 and KM-16.

Seasonal ground water elevations are typically higher by about 2 to 3 feet in the spring when compared with the fall water levels, as shown on Figures 3-3 through 3-5. These figures demonstrate little change in site gradient direction by the consistent relative elevation changes between wells over time. However, well KM-8 water level changes with time show rising trends resulting in smaller vertical gradients between nested wells KM-8, KM-12 and KM-19. The reason for this change may be the result of a reduction of ground water salinity over time in well KM-8 (Appendix A).

3.3 Ground Water Quality

3.3.1 Tronox Monitor Wells

The intent of evaluating water quality from the monitoring well network is to focus on the performance of the network using COC concentrations. Table 3-1 presents an evaluation of each of the monitor wells with respect to changes in COC, and location relative to monitored facility and ground water most heavily impacted from site COC. These results are based on the validated ground water quality data for the Tronox site that is evaluated on an annual basis and summarized in the annual comprehensive report of ground and surface water quality, provided in Appendix A to this monitor well placement evaluation.

The annual report evaluates trends for COC and other constituents that indicate significant trends. The annual report for 2007 concluded that concentrations of common ions and TDS have generally decreased with time in the Tronox wells, with a few exceptions. This trend has flattened somewhat between 2000 and the present for a number of the on-site wells near the west side of the facility as these concentrations approached background. A rising nitrate trend has been noted at some well locations near the covered S-X pond. Nitrate plus nitrite concentrations have doubled in well KM-8 between 2001 and 2007. Rising nitrate plus nitrite is also noted in shallow well KM-4 west of the calcine cap and the covered scrubber pond.

Vanadium and molybdenum currently exceed the RBC at most of the POC wells and non-POC wells, as shown in Table 1-2. Ground water molybdenum concentrations in monitor wells KM-5 and KM-9 fell below the RBC in 2003, rose slightly for a few years, then fell below the RBC once again in 2008. Molybdenum and vanadium concentrations generally decreased with time in nearly all POC wells as indicated in Table 3-1, although the ground water from monitor well KM-3 has constant molybdenum concentrations since around 2001. Only one well, on-site deep well KM-19 was below the RBC for all COC in 2007.

Manganese concentrations decreased with time in nearly all wells following LSE and remedial actions completed in 1997 (see Appendix A). Manganese concentrations decreased much quicker than vanadium and molybdenum concentrations following LSE. However, manganese currently exceeds the RBC in two of the Tronox POC wells as shown in Table 1-2. Well KM-3 ground water indicates an increasing manganese trend since 2001. The ground water from monitor well KM-8 manganese concentrations are seasonal. Ground water concentrations decreased substantially in KM-8 between 1997 and 2004, but currently concentrations of manganese are increasing and remain an order of magnitude greater than the RBC as shown in Table 1-2.

Arsenic was less than detection (5 ug/l) at most Tronox wells in 2007, as detailed in Appendix A. Arsenic was identified at small concentration in shallow ground water. Concentrations of arsenic in ground water are greater than 10 ug/l near the reclaimed scrubber pond with no noted concentration trend. Arsenic concentrations increased between May 1995 and 2002 in the ground water monitored by KM-8, and declined through 2005.

Concentrations of TBP and TPH slightly exceed the RBCs in well KM-8 ground water. TPH indicates a decreasing ground water trend through 2005 with little change to the present as detailed in Appendix A. TBP indicates an overall decreasing trend since LSE was implemented in 1997 through 2005 with a seasonal pattern within this range to the present

3.3.1.1 Tronox Ground Water Levels and Concentration Changes

Increasing COC concentrations noted at several wells following the winter of 2004-2005 are in part observed to correlate with rising water levels in the aquifer following years of drought and lowered water levels. Some of this apparent correlation could be caused by changes in precipitation in general rather than changes in water levels as demonstrated by the correlation between precipitation and water levels on Figure 3-2. However, seasonal COC concentration fluctuation trends are noted at a number of site well locations, including wells KM-2, KM-3, KM-6, KM-8, KM-15, KM-16 and KM-18 as shown in Table 3-1.

Ground water in monitoring wells KM-6 and KM-16 in particular, appear to indicate consistent COC ground water concentration changes seasonally when compared with changes in ground water levels and overall annual changes in moisture. This comparison of water levels with COC trends is demonstrated on Figures 3-6 through 3-11. These seasonal effects are notable between 2001 and in 2005 for molybdenum and vanadium, but seasonal effects for manganese are still observed to a smaller degree.

Increasing concentrations for several constituents in wells KM-6 and KM-16 following 2004 appear correlative to rising water levels in the aquifer following years of drought. Wells KM-6 and KM-16 are centrally positioned within the larger hydraulic conductivity areas directing larger concentrations of COC to be transported in a southwesterly direction. Both wells indicate seasonal fluctuations and demonstrate a delayed response to LSE and pond basin remediation performed between 1995 and 1997. The delayed response may be due to the increased distance to these well locations.

3.3.2 Monsanto Wells

Monsanto monitor wells that are placed along the eastern edge border the of the Monsanto site include production wells PW-1 through PW-4, TW-33, TW-38 and TW-12. Wells TW-56 and the Lewis Well are located south of the Monsanto property line and are routinely monitored by Monsanto. All of these wells are monitored for manganese, molybdenum, and vanadium. These wells, as shown on Figure 3-1, are all located at downgradient locations from the Tronox wells. Molybdenum trends from the annual report (Golder, 2007, Appendix B) and shown on Figures 3-12 through 3-16 indicate substantial decreases in molybdenum in downgradient wells TW-33, and TW-12 following 1993, nearly identical to the decreasing trends noted in Tronox wells KM-15 and KM-18 (Appendix A).

The Lewis well is the furthest and most downgradient well yielding ground water impacted by molybdenum but indicating little to no impact from vanadium. Figure 3-12 shows that molybdenum concentrations in the Lewis well peaked in 1997 and decreased immediately following LSE in 1997 (Golder, 2007, Appendix B). Big Spring trends shown on Figure 3-12 agree with analytical results obtained by Tronox. City Park Spring, shown on figure 3-12 shows increasing molybdenum through 2003 and decreasing trends to the present. Vanadium trends were not available for review for these sites monitored by Monsanto.

Figure 3-13 shows that molybdenum concentrations in well TW-12 rapidly declined starting in 1993 with a flattening of the slope beginning in 2001. Figure 3-14 indicates that well TW-56 has slowly increasing molybdenum concentrations with time since 1993, although the ground water concentration is about half of the RBC. Figure 3-13 indicates that TW-33 has a similar decay trend to TW-12 for molybdenum, although TW-33 began to flatten a few years prior to this observed trend in TW-12 (Golder, 2007, Appendix B).

The 2007 Monsanto report (Appendix B) indicates that molybdenum and vanadium are captured by the Monsanto production wells PW-1 through PW-4. In 2007, mean vanadium concentrations obtained from production wells PW-1 through PW-4 were 33.4 ug/l while molybdenum concentrations averaged about 35 ug/l. Although the production rates from each well is not known, total discharge from these wells was estimated to be about 1,200 gpm (Dames & Moore, 1995) during the RI. Assuming a similar pumping rate for 2007, based on the comparable water level elevations shown on Figure 3-1, it is estimated that 175 pounds of vanadium and 186 pounds of molybdenum are removed for the production of elemental phosphorus by Monsanto on an annual basis.

3.3.3 Evergreen Wells

Four 2-inch PVC monitoring wells are routinely sampled at the Evergreen site by Sprague Environmental. Results are contained in Appendix C. Two of these wells, EV-1 and EV-2 are downgradient of the Tronox wells at the locations shown on Figures 3-16 and 3-18. Site gradient beneath the Evergreen facility is west-southwesterly, (Sprague Environmental, 2008).

Monitoring wells EV-1 and EV-2 are located hydraulically upgradient of the Evergreen site, and are therefore assumed to be unaffected by former Evergreen fertilizer production at the site. Evergreen data indicate (contained in Appendix C) that wells EV-3 and EV-4 are downgradient or laterally downgradient of Evergreen site (Sprague

Environmental, 2008) and are therefore analytical results from EV-3 and EV-4 are not considered in this evaluation of monitor well placement.

Figures 3-16 through 3-18 demonstrate Evergreen well concentration trends of manganese, molybdenum, and vanadium plotted with the Tronox monitoring well ground water data. The concentration data demonstrate very similar decreasing trends with time when compared with the Tronox data, indicating that molybdenum is attenuating in the basalt aquifer, being removed by the Monsanto production wells, or migrating towards Bear River and Big Springs.

3.3.4 Off-Site Springs

Tronox routinely monitors surface water quality at four spring locations. The springs that are sampled include Finch Spring, Big Spring, and Upper and Lower Ledger Springs. The water from the springs is analyzed for general indicator parameters, common ions, and metals. Finch and Big Spring water concentrations exceed the RBC for molybdenum only. Both locations continue to indicate decreasing trends for molybdenum. Data obtained by Golder corroborate this finding for Big Spring.

Finch Spring originates from the base of the Finch Spring Fault scarp, approximately 4000 feet to the south of the Tronox facility, shown on Figure 3-1 and forms a small pond. Finch Spring has been routinely sampled since 1991 and appears to represent a southern and most downgradient boundary to measurable vanadium in surface water. Finch Spring is assumed to represent ground water quality at this location, since the spring is derived from ground water along the base of the fault.

Big Spring is the most distant spring relative to the site, located approximately 4 miles south of the facility and south of the town of Soda Springs and is believed to be impacted from both the Monsanto facility and from the vanadium plant. Big Spring emerges from alluvium at the south end of the valley floor and flows into Hatchery Creek and then into the Bear River. Flow from this spring is considerably greater than

Finch Spring, although this flow was smaller than normal between 2001 and 2004 due to several years of below normal precipitation. Discharge from Big Spring was approximately 17.6 cfs (7,900 gpm) in May 2007, whereas discharge from Finch Spring ranges from about 10 to 40 gpm. Vanadium remains at or below the detection limit in Big Spring.

Big Spring was first sampled by Kerr-McGee in 1993 and is currently sampled by Monsanto and Tronox. Results from sampling of Big Spring are presented in Appendix A and Appendix B. Results from both Monsanto and Tronox show that molybdenum concentration increased through 1997 and began decreasing at Big Spring following LSE at the site. Therefore, it is observed that the molybdenum concentration is decreasing at nearly all monitoring locations between the Tronox facility boundary and the furthest most downgradient point observed at the Bear River, indicating that molybdenum is attenuating in the basalt aquifer and being removed to the Bear River at Big Spring. Assuming an average flow rate of 17.6 cfs and a molybdenum concentration of 210 ug/l, an estimated 7,400 pounds of molybdenum are discharged from the aquifer to Big Spring on an annual basis based on May 2007 data.

Upper and Lower Ledger Spring surface approximately 3,300 feet to the southeast of Finch Spring and issue from basalt. In June 2000, EPA requested Kerr-McGee resume routine sampling of Upper and Lower Ledger Springs. These springs were first sampled by Kerr-McGee in 1991. These springs are a source of drinking water for Soda Springs. The analytical results are plotted as a function of time and are presented in Appendix A. Concentrations of metals are typically less than detection in Upper and Lower Ledger Springs, although molybdenum and vanadium are infrequently detected at concentrations near the detection limits. Water quality at Upper and Lower Ledger Springs does not appear to be impacted from former site operations based on May 2007 water quality results.

3.4 Adequacy of Well Placement - Defined Areas of COC in Ground Water

The following sections provide an analysis of the monitor well placements within and outside of defined areas of COC in ground water exceeding the RBC, both on the industrial facility and downgradient of the point of compliance. Although the ground water from most of the wells, with the exception of deep well KM-19, exceed the RBC for at least one COC as shown in Table 3-1, the main transport of COC across and off the industrial facility occurs along pathways of greatest hydraulic conductivity between wells KM-6 and KM-15 and KM-16, as demonstrated on Figure 2-1 and on Figures 3-19 through 3-21.

3.4.1 Manganese

The wells that are located within the areas of largest manganese impact to ground water are shown on Figure 3-19. Elevated manganese concentrations in ground water extend from the west side of the former scrubber pond in KM-3 in a westerly direction towards KM-6 and KM-8 (Appendix A). The largest manganese concentrations appear centered about the south end of the covered S-X pond basin, with a trend towards the south towards KM-16. Manganese concentrations have decreased with time in nearly all of the monitoring wells relatively quickly following LSE (see Appendix A). Recent manganese concentrations (May 2007) in TRONOX monitor wells are summarized in Table 1-2.

May 2007 manganese concentrations in ground water for on-site Tronox wells range from less than detection in well KM-19 to 5,000 ug/l in well KM-8 (see Appendix A). In May 2007, the RBC for manganese (180 ug/l) was exceeded in two POC wells, KM-3 (560 ug/l) and KM-8 (5,000 ug/l). Manganese does not exceed the RBC to the south or west of the POC wells in either the Evergreen wells or in the Monsanto wells utilized in this evaluation. Manganese was reported to be less than the detection limit to 2.6 ug/l at Upper and Lower Ledger Spring. Manganese was also less than the detection limit Finch and Big Springs during May 2007.

The current monitor well scenario defines the off-site migration of manganese. Downgradient wells at Evergreen and Monsanto confirm this finding.

3.4.2 Molybdenum

Molybdenum is readily soluble in water, and is more mobile than vanadium in the ground water. Multiple valence states are a complicating factor in molybdenum chemistry. The anionic (molybdate) species are probably predominant in natural water (Hem, 1978).

Molybdenum concentrations indicate an overall decreasing trend with time (See Appendix A). Molybdenum concentrations in Tronox monitor wells for May 2007 are summarized in Table 1-2. Molybdenum was a dominant metal in the S-X raffinate stream, and therefore is found in greater ground water concentrations near former S-X and scrubber pond source locations. During May 2007, on-site well concentrations of molybdenum ranged between 23 ug/l in deep monitoring well KM-19 to 41,000 ug/l in well KM-8.

Figure 3-20 shows the placement of the wells for all three facilities defining the most heavily impacted ground water areas. Figure 3-20 illustrates that concentrations of molybdenum are elevated in areas centered to the south end of the former S-X pond and about the perimeter of the covered scrubber pond. This area of elevated molybdenum in the ground water follows the zone of larger hydraulic conductivity to the southwest towards wells KM-15 and KM-18, Evergreen well EV-1, and as far west as Monsanto well TW-12. Monsanto wells TW-33 and TW-38 located to the west of the Tronox facility show molybdenum concentrations in the range of 50 ug/l. This concentration is slightly greater than the average molybdenum concentrations being removed by the Monsanto production wells PW-1 through PW-4.

Molybdenum exceeds the RBC (180 ug/l) in all of the on-site wells with the exception of wells KM-5, KM-9 and KM-19, as shown in Table 1-2. The molybdenum RBC is exceeded at all Tronox well locations to the south of the industrial facility, and at Finch Spring and

Big Spring. Molybdenum was less than the detection limit in Upper and Lower Ledger Spring during May 2007.

The current monitor well placements within the ground water areas most heavily impacted by molybdenum define off-site migration from the industrial facility. However, the well placement does not define the easternmost edge of the molybdenum RBC. Trend analysis of molybdenum in well KM-17 shows concentrations peaked in 2000 and have been decreasing since that time (see Appendix A). Molybdenum concentrations in well KM-17 are within the same range as the Evergreen wells, as shown on Figure 3-20.

3.4.3 Vanadium

May 2007 ground water vanadium concentrations in the Tronox monitor wells are summarized in Table 1-2. Vanadium concentrations in ground water are decreasing with time at most locations, but at a slower rate when compared with manganese, and molybdenum. Vanadium is detected at concentrations above the RBC (260 ug/l) in all of the on-site wells with the exceptions of intermediate well KM-11 and deep well KM-19 a shown in Table 1-2. Vanadium concentrations ranged between 10 ug/l in KM-11 and 18,000 ug/l in well KM-8 (see Appendix A).

Vanadium was a dominant metal in the S-X raffinate stream. Vanadium in the ground water at the site is predominantly found in the pentavalent state. Transport of vanadium in water and soil is influenced by redox potential, pH, and the presence of particulate (USHHS, 1990). Vanadium species have a tendency to bind strongly to mineral or biogenic surfaces by adsorption or complexing; hence it can be transported either in solution or in suspension. Adsorption may be the most significant attenuating factor for vanadium.

Figure 3-21 illustrates the distribution of vanadium concentration in ground water beneath and downgradient of the site. Larger vanadium concentrations are consistently identified near the south end of the reclaimed S-X pond and west of the southern half of the calcine

cap and the covered scrubber pond. Vanadium concentrations in off-site Tronox monitor wells located southwest of the site exceed the vanadium RBC, as well as Monsanto well TW-12 and Evergreen well EV-1, as shown on Figure 3-21. Based on the concentration in well TW-33 at Monsanto, vanadium persists on the eastern portion of the Monsanto site in as ground water impacted from the Tronox site is drawn in the direction towards the production wells and discharged.

To the south of the industrial facility boundary, ground water from monitor well KM-17 (18 ug/l) remains substantially less than the RBC for vanadium, and defines the eastern boundary of vanadium in the ground water. Elevated vanadium concentrations extend southwesterly along a zone of larger hydraulic conductivity from the industrial facility boundary towards the Evergreen facility, defining the southeastern position of vanadium in ground water in an area close to Finch Spring. The largest concentrations of vanadium are projected to be found between KM-15 and the Evergreen facility. The areas of highest vanadium concentration in ground water are projected to be found between highway 34 and Finch Spring. Monsanto wells TW-56 and to the south, the Lewis well, show vanadium at or near the detection limit.

During May 2007, the vanadium concentration in Finch Spring was 58 ug/l and 2.5 ug/l at Big Spring. Vanadium was less than the detection limit of 10 ug/l in Upper and Lower Ledger Springs.

The current monitor well placements within the ground water areas most heavily impacted by vanadium appear to define off-site migration from the industrial facility at the POC. These monitor well data supplemented with the Monsanto and Evergreen well data define the eastern and western downgradient boundaries. The downgradient RBC boundary for vanadium cannot be determined from these data.

3.5 Adequacy of Well Placement - Movement of COC in Ground Water

One of the goals of this monitor well evaluation is to assess whether the existing monitor wells are adequately located to demonstrate that COC in the ground water are attenuating rather than migrating in a downgradient direction (EPA, 2008). Earlier in this chapter, the downgradient Monsanto wells were shown to demonstrate rapid decreases in molybdenum following LSE at the Tronox site. Evergreen COC data that are shown plotted with the off-site well data and show that the downgradient Evergreen wells are decreasing at nearly the same rate as the off-site downgradient wells, as demonstrated on Figures 3-16 through 3-18, Figure 3-27 and Figure 3-34. This demonstration indicates that the mass of COC is decreasing steadily at nearly all downgradient locations at consistent rates. This indicates that a larger mass of COC is not migrating downgradient from the site and that COC is not increasing downgradient. The remedy was actually implemented in phases; the calcine was capped in 2001, the S-X pond was emptied in 1996, the scrubber pond was mostly empty in 1997 and the MAP ponds that affected off site and Monsanto monitor wells were removed from service in 1993. All of these actions indicate reduced ground water COC concentrations (Appendix A) that occurred prior to November 1997. However, in order to demonstrate that COC are decreasing at downgradient locations, a comparison of the wells is made by normalizing the data and plotting the relative percent decrease of COC molybdenum and vanadium from the time of LSE, November 1997. The initial concentration (C_o) for each well at the November 1997 sampling round is selected for continuity of data evaluation.

3.5.1 Molybdenum Decay in Aquifer

As part of the FS, concentrations of COC following LSE were modeled to decay to background concentrations over time. Measured reductions in ground water concentration of molybdenum in the monitor wells and off-site springs are represented by decay plots shown on Figure 3-22 through Figure 3-28. Molybdenum is a COC that is found above the RBC from the site to the most downgradient point, Big Spring. While

some of the mass is discharged at Finch Spring, a substantial mass of molybdenum at concentrations greater than the RBC is transported in a southerly direction, bounded within the area between Finch Spring and Monsanto well TW-12, eventually discharging to Big Spring, as shown on Figure 3-20. The remainder of the molybdenum moves directly west off-site and is removed by Monsanto production wells, or complexes and becomes fixed in the basalt aquifer.

Intermediate depth wells KM-11, KM-12 and KM-18 shown on Figure 3-22 indicates that molybdenum decay is occurring at nearly the same rate in ground water monitored at all three locations, both on and off-site. Concentrations of molybdenum in the intermediate wells are now about 18 to 35 percent of the initial concentration at the time of LSE.

Shallow wells near the covered scrubber pond and off-site well KM-17 are shown on Figure 3-23. This figure demonstrates that molybdenum increased by up to 60 percent in well KM-17 by 2002. Concentrations of molybdenum in wells KM-2 and KM-3 are decaying relatively more slowly than KM-4. Concentrations of molybdenum in the wells near the covered scrubber pond are now about 10 to 23 percent of the initial concentration at the time of LSE. Well KM-17 is about 20 percent recovered from 1997 concentrations.

Shallow wells on the west side of the site and downgradient off-site well KM-15 are shown on Figure 3-24. Concentrations of molybdenum in wells KM-5 and KM-9 are decaying relatively more slowly than wells KM-13 and downgradient well KM-15. Concentrations of molybdenum in the wells near the covered S-X pond are now about 10 to 45 percent of the initial concentration at the time of LSE. This figure demonstrates that downgradient site trends are not increasing relative to on-site trends. Figure 3-25 for well KM-8 shows a similar pattern to KM-13, with about 35 percent of the initial concentration remaining.

Shallow wells in the central COC ground water zone including well KM-6 and downgradient off-site well KM-16 are shown on Figure 3-26. Concentrations of

molybdenum in well KM-6 are decaying relatively more slowly than in downgradient well KM-16, indicating that concentrations of molybdenum at downgradient sites are not increasing relative to on-site trends and that an increasing mass of COC is not moving downgradient.

Figure 3-27 shows post-LSE molybdenum decay in the most downgradient wells and plots these with available data from the Evergreen site. Results indicate that the Evergreen wells, located even further downgradient than the off site wells, are decaying at the same, or at a greater rate than the downgradient Tronox wells and that an increasing mass of COC is not moving downgradient from Evergreen.

Figure 3-28 shows post-LSE molybdenum decay in the most downgradient wells and plots these with concentration decay rates measured at Finch and Big Spring. Results indicate that the springs, located even further downgradient than the off-site wells, are decaying at the same, or at a greater rate than the downgradient Tronox wells. Finch Spring molybdenum concentration is decaying at a faster rate than Big Spring molybdenum concentration, with both locations indicating 35 to 55 percent of initial concentration. Results by comparison indicate that an increasing mass of COC is not moving downgradient from the site.

3.5.2 Vanadium Decay in Aquifer

As part of the FS, concentrations of the COC vanadium following LSE were modeled to decay to background concentrations over time. Measured reductions in ground water concentration of vanadium in the monitor wells are represented by decay plots shown on Figures 3-29 through Figure 3-34. Similar to the observed distribution of molybdenum in ground water, vanadium in the aquifer moves off-site in a westerly direction towards the Monsanto production wells. A well-defined mass of vanadium at concentration above the RBC is transported in the basalt aquifer in a southerly direction off of the site towards Monsanto well TW-12 as shown on Figure 3-21. The remainder of the vanadium is removed by Monsanto production wells, is discharged at Finch

Spring, or becomes fixed in the basalt aquifer in the area beneath the Soda Springs industrial park. Vanadium is at the detection limit at Big Spring and in City Park Spring (a location that is sampled by Monsanto, Figure 3-12), but is less than detection in the Ledger Springs. Historic well sampling of private wells south of Soda Springs in June 2000 (Beckstead, Hildreth, Edith Steele, Mark Steele) showed concentrations of vanadium at the instrument detection limit. Surface water sample results on Highway 36 near Hooper Springs Rd in 1999 indicated a vanadium concentration of 8.5 ug/l. Therefore, vanadium is not found in concentration above the detection limit in ground water south of wells TW-12 and EV-2. There is no current evidence indicating that vanadium is transporting within the aquifer toward Soda Springs, based on these data (Figure 3-21).

Intermediate depth wells KM-11, KM-12 and KM-18 shown on Figure 3-29 indicate that vanadium decay is occurring in the ground water at nearly the same rate in all locations, with KM-11 recovery at a slightly greater rate. Concentrations of molybdenum in the intermediate-depth wells are now about 50 percent of the initial concentration at the time of LSE (November 1997).

Shallow wells near the covered scrubber pond and off-site well KM-17 are shown on Figure 3-30. Concentrations of vanadium in well KM-3 is decaying relatively more slowly than the other wells. Concentrations of vanadium in the wells near the covered scrubber pond are now about 35 to 50 percent of the initial concentration at the time of LSE.

Shallow wells on the west side of the site and downgradient off-site well KM-15 are shown on Figure 3-31. Concentrations of vanadium in all of these wells are decaying at a relatively equal rate, with all wells in this group at about 50 percent of the initial concentration. This figure demonstrates that downgradient site trends are not increasing relative to on-site trends. Figure 3-32 for well KM-8 shows that vanadium concentrations have increased about 250 percent since the initial concentration at the

time of LSE, indicating localized impacts to ground water in well KM-8 unrelated to removal of the liquid source.

Shallow wells in the central COC ground water zone including well KM-6 and downgradient off-site well KM-16 are shown on Figure 3-33. Concentrations of vanadium in the wells near the covered scrubber pond in 2007 were about 62 to 75 percent of the initial concentration at the time of LSE. Slow decay function is largely due to increased vanadium concentrations between May 2005 and May 2007, a period representing slightly increased precipitation. Figure 3-33 demonstrates that concentrations of vanadium in well KM-6 are decaying more slowly than in downgradient well KM-16, indicating that concentrations of vanadium at downgradient sites are not increasing relative to on-site trends and that an increasing mass of COC is not being transported in a downgradient direction.

Figure 3-34 shows post-LSE vanadium decay in the most downgradient wells and plots these with available data from the Evergreen site. Results indicate that the Evergreen wells, located even further downgradient than the off-site wells, are decaying at the same, or at a greater rate than the downgradient Tronox wells. Data results indicate that an increasing mass of COC is not moving downgradient from Evergreen.

3.6 Long-term Monitoring Optimization

With the exception of internal monitoring wells KM-1, KM-4, KM-6, KM-7, KM-10 and the off-site wells KM-15 through KM-18, remaining wells are monitored for point of compliance with RBC. Table 3-2 provides recommendations for changes in monitoring frequency of wells and springs, based on this monitoring well evaluation, and the evaluation of trends contained in Appendix A.

Recommended changes to the monitoring plan can be made without reducing the resolution of data points required to assess remedy performance. In general, ground water seasonal trends are as important to remedy evaluation as are the long-term

trends, whereas concentration trends that decay more slowly or are relatively flat have less import to the understanding of the remedy performance.. Therefore, recommended changes for the long-term monitoring include:

- Continued semiannual monitoring for most POC wells that continue to show decreasing trends or seasonal fluctuating trends;
- Recommended annual monitoring for POC wells with flat trends and internal non-POC wells;
- Well KM-19 has already achieved the clean-up goals and could be monitored less frequently (i.e. annually);
- Semiannual monitoring of off-site wells and springs should continue as the result of noted significant seasonal fluctuations and the importance of these well sites for defining areas of off-site migration of COC;
- For future sampling events, POC wells that indicate ground water concentrations below the RBC could have monitoring frequency reduced to annual monitoring (based on mutual agreement with EPA) to ensure concentrations do not climb above the RBC.

4.0 CONCLUSIONS

4.1 Adequacy of Monitoring Well Placement

Based on this monitoring well evaluation that assessed spatial distribution of hydraulic conductivity in the aquifer (Section 2.3), relationship between transient concentrations and water levels (Section 3.2), and distribution and movement COC in ground water for 2007 (Section 3.4), the existing monitoring well network is adequately placed to define the ground water pathways for COC exiting the facility point of compliance. Water level flow directions to the south of the calcine cap indicate flow in a more southerly direction in this general area as the result of a flatter gradient, based on well KM-2 and KM-3 water level elevations. However, well KM-17 water levels and concentration trends for molybdenum suggest that ground water south of the cap area is monitored by well KM-17 as the gradient transports ground water to the east. Use of the available data in 2007 from the Monsanto and Evergreen sites (Appendices B and C) in conjunction with the data collected from the Tronox wells (Appendix A) allows for a more complete understanding of off-site transport and the areal limits to the COC impacts to ground water.

Analysis of water level changes with time indicates that the Tronox wells demonstrate relatively uniform seasonal change in the water levels between wells, and therefore little significant change occurs over time in the gradient or flow directions beneath or off of the site. This is further confirmed when comparing the 2007 gradient with the site gradients for 1993 that were evaluated in the RI. Therefore, no changes to the current monitoring system appear warranted based on changes in gradient or site water levels.

Observation of COC concentration decay on site and at ground water monitoring locations downgradient of the site indicates that the data from the existing monitoring well network used in conjunction with the Evergreen, Monsanto and off-site spring surface water data demonstrate that COC concentrations are decaying at nearly all locations since LSE was implemented. Manganese decayed relatively quickly beyond

the POC following LSE. Molybdenum that is not removed by Monsanto production wells attenuates in the aquifer, or is discharged at Big Spring. Decay curves indicate that vanadium is transported much more slowly through the aquifer than manganese and molybdenum, and vanadium concentrations approach the detection limit south of Finch Spring. Therefore, the monitoring well network does not necessarily define the southern most edge for the vanadium levels at the RBC as with the case of molybdenum exceeding the RBC at Finch Spring

4.2 Adequacy of Monitoring Program and Proposed Program Changes

The current monitoring program is sufficient to monitor releases from the site to ground water as well as defining releases from the industrial site and the POC. The COC boundaries are defined by Tronox, Monsanto, Evergreen and private wells in Soda Springs and surface water sample locations. The spatial distribution of the wells within the areas most impacted by COC indicate that vanadium is attenuating within the aquifer and that downgradient monitored locations are decreasing in COC concentration at rates comparable to most monitored locations on the site.

The current frequency of ground and surface water monitoring and the list of analytes used for the Kerr-McGee Soda Springs, Idaho Superfund site are sufficient to monitor the site remedial actions completed between 1997 and 2002. The proposed changes to the ground water and surface water monitoring program that are detailed in Section 3.6 and shown in Table 3-2 can be implemented without a loss of understanding of the temporal changes in COC concentration and the transport of COC in the ground water.

5.0 REFERENCES

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TABLE 1-1
CHRONOLOGY OF PROCESS CHANGES

Event	Date(s)	Comments
S-X stream diverted from the S-X pond to the scrubber pond	1992 through 1993	Flow may have been diverted between ponds during this time period.
MAP ponds taken out of service; third roaster taken off-line in April	1993	Ponds reclaimed. Effects of remediation observed in well KM-5.
S-X pond receiving discharge from S-X circuit	1994	S-X circuit discharge diverted to S-X pond for last time.
S-X stream diverted from the S-X pond to the scrubber pond	Late 1994 to mid 1995	S-X pond contained residual process water during 1995
S-X stream diverted to newly-constructed lined ponds	Mid 1995	Precipitation continued to fill the S-X pond basin and infiltrate. Pond contained significant volume of precipitation during 1996-1997 winter.
Scrubber pond taken out of service	April 1997	Scrubber pond pumped to the calcine pond. Some scrubber water sent to calcine ponds. Residual liquid in pond and meteoric water drained out during stabilization of the pond sediments. All baghouses on-line in October.
Discontinue sluicing calcine	April – October 1997	Calcine dewatered, and residual water recycled in process. Dewatered calcine stockpiled north of the calcine impoundment.
Fertilizer plant operational	July 1998 to May 2000	Calcine removed from active calcine Impoundment, processed to fertilizer. Reject fertilizer placed in calcine impoundment.
Discontinue Vanadium Processing – Vanadium Plant Idle	January 1999 to present	Discontinue stockpiling of calcine, discontinue all vanadium process streams to lined ponds, discontinue the recycle of roaster reject.
Cap Active Calcine Impoundment	May 2001 through August 2001	Calcine was capped using multi-component cover to eliminate meteoric infiltration through calcine tailing. Substantial amount of dust control/construction water used.
Dismantle Vanadium Plant	November 2001 through May 2002	Materials removed to approved facility, surface footprint cleaned in preparation for surface regrade. Footprint regraded with limestone fines in April/May 2003
Dismantle Fertilizer Plant	November 2002 through June 2003	Materials removed to approved facility, surface footprint cleaned in preparation for surface regrade.
Reclaim Stormwater Runoff Ponds	September through October 2003	Solids and liquids removed to 10-acre pond, site regraded and reclaimed.
Reclaim 5-Acre Ponds (Stormwater)	September through October 2004	Solids and liquids removed to 10-acre pond, east pond site regraded and reclaimed.
Regrade Scrubber Pond Cover	November 2005	Fill and regrade south of calcine cap

Note: Changes in the discharge locations of both the S-X and scrubber streams affected concentrations in both on-site and off-site wells and Finch Spring during operation.

TABLE 1-2
MAXIMUM CONCENTRATIONS OF COC AND MAY 2007 CONCENTRATIONS IN TRONOX WELLS AND OFF-SITE SPRINGS

Well Designation	Arsenic Concentrations		Manganese Concentrations		Molybdenum Concentrations		Total Petroleum Hydrocarbons Concentrations		Tributyl Phosphate Concentrations		Vanadium Concentrations	
	PROPOSED RBC = 10 ug/l		RBC = 180 ug/l		RBC = 180 ug/l		RBC = 0.73 mg/l		RBC = 180 ug/l		RBC = 260 ug/l	
	Largest (ug/l)	Most Current (ug/l)	Largest (ug/l)	Most Current (ug/l)	Largest (ug/l)	Most Current (ug/l)	Largest (mg/l)	Most Current (mg/l)	Largest (ug/l)	Most Current (ug/l)	Largest (ug/l)	Most Current (ug/l)
KM-2*	53	13	444	38	11800	1100	2.0	NA	7	NA	15500	5000
KM-3*	27	13	1680	560	44900	6400	1.8	NA	1400	NA	13200	2300
KM-4	63	10	1160	90	15300	2200	NA	NA	NA	NA	23300	6400
KM-5*	12.2	ND	399	7.1	1460	200	NA	NA	3	NA	15800	1300
KM-6	6.5	6.3	291	180	2140	1400	2.0	NA	110	NA	6630	4500
KM-7	6.9	ND	197	94	593	300	2.0	NA	NA	NA	3410	2100
KM-8*	170	90	8770	5000	165000	41000	9.5	1.5	4442	590	29000	18000
KM-9*	5	ND	113	6.6	1740	160	NA	NA	ND	NA	3590	410
KM-11*	2	ND	157	16	5600	300	0.42	NA	112	NA	492	10
KM-12*	23	ND	177	29	9290	470	0.39	NA	13	NA	5580	660
KM-13*	4	ND	131	7.7	6790	220	0.18	NA	12	NA	6420	520
KM-15	5.6	ND	543	54	6950	450	0.15	NA	484	NA	3840	940
KM-16	7.3	ND	364	110	2300	780	1.9	NA	180	NA	4250	2400
KM-17	1.5	ND	84	2.6	987	350	1.2	NA	170	NA	493	18
KM-18	3.7	ND	332	47	6340	410	1.3	NA	410	NA	2990	720
KM-19*	2	ND	32.3	ND	258	23	1.1	NA	4	NA	558	130
Big Spring	1.1	ND	1.8	ND	508	210	NA	NA	NA	NA	13.6	2.5
Finch Spring	2	ND	4.4	ND	663	190	0.22	NA	ND	NA	91.7	58
Upper Ledger	3.7	ND	2.6	2.6	22.4	ND	NA	NA	NA	NA	5.1	ND
Lower Ledger	4.2	ND	1.5	ND	54.1	ND	NA	NA	NA	NA	14.9	ND

Footnotes:
* = Point of Compliance Well
NA = Not Available – not sampled during May 2007
ND = Not Detected (less than IDL)
Shaded cells indicate exceedence of RBC

TABLE 2-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
KM-1 (shallow well paired with KM-10)	Lateral gradient background well	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, No organics	No	None	Background sampling not needed; relying on RBC performance standards at POC wells and no statistical background comparison
KM-2 (shallow well)	Active calcine tailing impoundment/former scrubber pond area	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; No organics	Point of compliance well, although not truly downgradient of calcine or former scrubber pond; monitor changes in ground water concentrations in conjunction with changes at active calcine impoundment area and scrubber pond closure
KM-3 (shallow well paired with KM-11)	Reclaimed scrubber pond	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3,4 total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Point of compliance well; monitor changes in ground concentrations water along southern boundary in conjunction with scrubber pond closure
KM-4 (shallow well)	Active calcine tailing impoundment area	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1, 3, total chromatographable organics Round 1	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Will provide monitoring of calcine impoundment following capping. Not a POC well

TABLE 2-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
KM-5 (shallow well)	Historic scrubber pond/historic MAP ponds, Boiler blowdown pond/downgradient of facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; No organics	Point of compliance well, monitors downgradient of northern and central areas of entire plant facility; no active or historic activities downgradient of this location
KM-6 (shallow well)	Historic limestone Settling ponds	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Rounds 1, 3	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Monitors zone of increased transmissivity on the southern boundary of facility; not a POC well
KM-7 (shallow well)	Historic calcine impoundment area	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	No	None	Yes (2000-->)	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Monitors central portion of the facility and provides additional justification for contouring of COC; not a POC well
KM-8 (shallow well paired with KM-12 and KM-19)	Former S-X pond/ downgradient of plant facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, metals, radionuclides Rounds 1, 4, total chromatograph-able organics Round 1,3, TPH and semivols Rounds 4 and 8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP	Point of compliance well; monitor changes in ground water concentrations in conjunction with changes from S-X pond closure

TABLE 2-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
KM-9 (shallow well)	Former S-X pond/downgradient of plant facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; No organics	Point of compliance well, downgradient of entire facility; comparisons can be made with ground water model results to track and evaluate performance
KM-10 (intermediate well, paired with KM-1)	Intermediate depth background well	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	No	None	Background sampling not needed; relying on RBC performance standards at POC wells and no statistical background comparison
KM-11 (intermediate well, paired with KM-3)	Former scrubber pond	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; No organics	Point of compliance well; monitor changes in ground water concentrations in conjunction with scrubber pond closure
KM-12 (intermediate well paired with KM-8, KM-19)	Former S-X pond/ downgradient of plant facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Round 1, total chromatographable organics Round 1	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Point of compliance well; monitor changes in ground water concentrations in conjunction with changes from S-X pond closure
KM-13 (shallow well)	Former S-X pond (north end) and downgradient of plant facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Round 1, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Point of compliance well, downgradient of entire facility

TABLE 2-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
KM-15 (shallow well, paired with KM-18)	Off-site well southwest of former S-X pond and within main area of impacted ground water	Not completed prior to Round 5	Long-list metals Round 5, short-list metals Rounds 6 through 8, semivols and TPH Rounds 5-8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Located in off-site area near modeled point; current RBC exceedences of , Mo, and V
KM-16 (shallow well)	Off-site well south of former S-X and settling ponds	Not completed prior to Round 5	Long-list metals Round 5, short-list metals Rounds 6 through 8, semivols and TPH Rounds 5-8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Located off-site and laterally downgradient of the site; RBC exceedences of Mo, and V
KM-17 (shallow well)	Off-site well southwest of former scrubber pond and active calcine tailing	Not completed prior to Round 5	Long-list metals Round 5, short-list metals Rounds 6 through 8, semivols and TPH Rounds 5-8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Located off-site and laterally downgradient of the site; RBC exceedences of Mo
KM-18 (intermediate well, paired with KM-15)	Off-site well southwest of former S-X pond, pond and within main area of impacted ground water, paired with KM-15	Not completed prior to Round 5	Long-list metals, semivols and TPH Rounds 5-8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Monitors deeper aquifer zone for ground water impact; current RBC exceedences Mo, and V
KM-19 (deep well paired with KM-8 and KM-12)	Former S-X pond and downgradient of plant facility	Not completed prior to Round 5	Long-list metals Round 5, short-list metals Rounds 6 through 8, semivols and TPH Round 5	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Point of compliance well; monitor changes in ground water concentrations in conjunction with changes from S-X pond closure

TABLE 2-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
Finch Spring (spring discharging from base of Finch Fault to surface water)	Spring south of facility which has appeared to be impacted primarily from scrubber discharge	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, long-list metals, semivols and TPH Round 5	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Monitor downgradient changes to ground water from scrubber pond closure and other remedial actions on-site, current RBC exceedence of Mo
Big Spring (spring discharging to surface water flowing to Bear River)	Spring south of Soda Springs, furthest south discharge identified from Bear River Basin to Bear River	Not sampled prior to Round 6	Short-list metals	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Current exceedence of Mo RBC, too far from plant to measure direct changes associated with remedial actions; other influencing factor contributing to ground water upgradient of site and downgradient of KMCC, will continue to monitor
Upper Ledge(r) Spring (spring discharging from Ledger Creek drainage, between Kelley Park and Rabbit Mountain	An important source of drinking water for the town of Soda Springs. EPA requested additional monitoring of this spring by KMC LLC following public meeting and on amended ROD comments in June 2000.	1 Event (no impacts noted)	Long-list metals Round 1	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Monitor ground water quality

TABLE 2-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
Lower Ledge(r) Spring (spring discharging from Ledger Creek drainage, between Kelley Park and Rabbit Mountain	An important source of drinking water for the town of Soda Springs. EPA requested additional monitoring of this spring by KMC LLC following public meeting and on amended ROD comments in June 2000.	1 Event (no impacts noted)	Long-list metals Round 1	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Monitor ground water quality

TABLE 2-2
MONITOR WELL CONSTRUCTION DATA

Monitor Wells	Completion Date	Northing	Easting	Top of PVC Elevation Feet msl	Concrete Pad Elevation Feet)	Top of Screen	Bottom of Screen	Unit Monitored*	Lithology Screened Interval
KM-1	10/07/91	373073.394	659740.078	6029.72	6027.50	45.9	55.9	I4	clay, tuff
KM-2	09/21/91	371777.028	660379.196	6025.11	6023.00	47.2	57.2	Qb5	basalt, clay
KM-3	10/11/91	371745.657	659825.555	6014.28	6012.20	39.1	49.1	I4	clay, tuff
KM-4	10/02/91	372033.826	659695.190	6023.44	6021.90	43.7	53.7	I4	cinders, tuff
KM-5	10/01/91	372710.706	658856.602	6002.72	6001.50	38	48	Qb5	vesicular basalt
KM-6	09/24/91	371736.929	658601.626	5988.13	5986.00	34.7	44.7	Qb5	vesicular basalt
KM-7	09/26/91	372113.189	658578.407	6001.63	5999.90	46.2	56.2	Qb5/I4	vesicular basalt and cinders
KM-8	10/21/91	371771.964	658144.161	5976.75	5974.40	34.6	44.6	Qb5	basalt, clay
KM-9	09/29/91	371770.477	657836.280	5973.56	5971.50	47.5	57.5	Qb5	vesicular basalt
KM-10	10/12/91	373073.856	659761.715	6029.43	6027.90	100	120	Qb3	basalt
KM-11	10/29/91	371745.582	659847.119	6013.63	6012.10	80	100	Qb3	basalt
KM-12	10/29/91	371778.391	658119.553	5976.07	5973.90	134.1	154.1	Qb3	basalt
KM-13	10/07/91	372185.749	658042.505	5977.65	5975.60	46.4	56.4	Qb5	basalt
KM-15	09/24/92	370332.04	657491.89	5958.10	5956.20	45.2	55.2	Qb5a/I5	cinders, basalt
KM-16	09/18/92	371058.74	658151.12	5998.97	5997.20	63.3	73.3	Qb5	basalt
KM-17	09/25/92	371100.35	659365.30	6001.11	5999.60	38.2	48.2	Qb4/I3	basalt, silt
KM-18	10/03/92	370336.14	657468.67	5958.25	5956.80	152.6	172.6	Qb3	basalt
KM-19	10/15/92	371788.11	658085.74	5975.17	5973.80	193.6	213.6	Qb2/I1	fractured basalt, clay

*** Dames & Moore 1995**

TABLE 2-3
GROUND AND SURFACE WATER SAMPLE COLLECTION AND ANALYSIS

Well ID or Spring Name	Total Depth of Well (ft)		General Indicators, Anion, and Cations	Unfiltered Metals	SVOCs	TPH
KM-1	56	NOT SAMPLED				
KM-2	57		X	X		
KM-3	49		X	X		
KM-4	54		X	X		
KM-5	48		X	X		
KM-6	45		X	X		
KM-7	56		X	X		
KM-8	45		X	X	X	X
KM-9	58		X	X		
KM-10	120	NOT SAMPLED				
KM-11	100		X	X		
KM-12	155		X	X		
KM-13	56		X	X		
KM-15	54		X	X		
KM-16	73		X	X		
KM-17	48		X	X		
KM-18	172		X	X		
KM-19	218		X	X		
Finch Spring	N/A		X	X		
Big Spring	N/A		X	X		
Upper Ledger Spring	N/A		X	X		
Lower Ledger Spring	N/A		X	X		

TABLE 2-4
GROUND WATER PARAMETER AND ANALYTICAL METHODS

Analyte	Analytical Method (1,2)	Holding Time	Reporting Limit (3)
Alkalinity	310.1[(2)]	14 Days	5.0 mg/l
Total Dissolved Solids	160.1[(2)]	7 Days	10.0 mg/l
Turbidity	N/A	Analyze in field	
pH	N/A	Analyze in field	
Specific Conductance	120.1[(2)]	28 Days	2.0 umhos/cm
Ion Balance	1030F & API		
Bicarbonate	310.1	14 Days	5.0 mg/l
Carbonate	310.1	14 Days	5.0 mg/l
Chloride	300.0A	28 Days	3.0 mg/l
Fluoride	340.2	28 Days	0.1 mg/l
Nitrate+Nitrite	353.2	28 Days	0.1 mg/l
Sulfate	300.0A	28 Days	5.0 mg/l
Calcium	SW846 6010B	6 Months	200 ug/l
Magnesium	SW846 6010B	6 Months	200 ug/l
Potassium	SW846 6010B	6 Months	500 ug/l
Sodium	SW846 6010B	6 Months	2000 ug/l
Metals Digestion	SW846 3010A		
Aluminum	SW846 6010B	6 Months	100 ug/l
Arsenic	SW846 6010B	6 Months	10.0 ug/l
Barium	SW846 6010B	6 Months	10 ug/l
Cadmium	SW846 6010B	6 Months	5.0 ug/l
Cobalt	SW846 6010B	6 Months	10 ug/l
Copper	SW846 6010B	6 Months	20 ug/l
Manganese	SW846 6010B	6 Months	10 ug/l
Molybdenum	SW846 6010B	6 Months	20 ug/l
Nickel	SW846 6010B	6 Months	40 ug/l
Silver	SW846 6010B	6 Months	10 ug/l
Vanadium	SW846 6010B	6 Months	10 ug/l
TPH C-10 – C-36	SW846 6010B	28 Days	1.0 mg/l
Semi-Volatile Organic Compounds	8270C	7 Days (extraction) 40 Days (analysis)	Compound/ dilution-specific

TABLE 2-4
GROUND WATER PARAMETER AND ANALYTICAL METHODS
(Continued)

1. Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Office of Solid Waste, U.S. Environmental Protection Agency, Document Control No. 995-001-00000-1, 1986.

2. Methods for Chemical Analysis of Water and Waste, EPA-600/4-79/020, EMSL, Cincinnati, OH, 1983.

3. Reporting Limits, reported by STL, October 2002. Reporting limits vary with dilution.

TABLE 3-1
MONITOR WELL EVALUATION TABLE

Well ID	Well Use	Total Well Depth	Feet of Screen	COC Exceeding RBC	As Increasing or Decreasing?	Mn Increasing or Decreasing?	Mo Increasing or Decreasing?	V Increasing or Decreasing?
KM-1	Shallow Background	55.9	10	NA	Not Sampled	Not Sampled	Not Sampled	Not Sampled
KM-2	POC Well	57.2	10	As, Mo, V	No Trend	Decreasing	Decreasing	Decreasing
KM-3	POC Well	49.1	10	As, Mn, Mo, V	No Trend	Increasing since 2001	Flat since 2001	No trend
KM-4	Internal Facility Monitoring	53.7	10	As, Mo, V	No Trend	No trend	Decreasing	No trend
KM-5	POC Well	48	10	V	Less than detection	No Trend	Flat/slightly decreasing	Flat since 2002
KM-6	Edge of Facility Monitoring	44.7	10	As, Mo, V	Less than detection	No trend/rising since 2002	Flat/slightly increasing since 2002	Increasing since 2004
KM-7	Internal Facility Monitoring	56.2	10		Less than detection	Decreasing	Decreasing	Flattening since 2002
KM-8	POC Well	44.6	10	As, Mn, Mo, V	No Trend	Increasing since 2004	Increasing since 2006	No trend
KM-9	POC Well	57.5	10	V	Less than detection	No Trend	Flattening/slightly decreasing	Decreasing
KM-10	Intermediate Depth Background	120	20	NA	Not Sampled	Not Sampled	Not Sampled	Not Sampled

TABLE 3-1
MONITOR WELL EVALUATION TABLE

Well ID	Well Use	Total Well Depth	Feet of Screen	COC Exceeding RBC	As Increasing or Decreasing?	Mn Increasing or Decreasing?	Mo Increasing or Decreasing?	V Increasing or Decreasing?
KM-11	Intermediate Depth POC Well	100	20	Mo	Less than detection	No trend	Decreasing	Decreasing
KM-12	Intermediate Depth POC Well	154.1	20	Mo, V	Less than detection	No Trend	Decreasing	Decreasing
KM-13	POC Well	56.4	10	Mo, V	Less than detection	No Trend	Decreasing	Decreasing
KM-15	Off-Site Well	55.2	10	Mo, V	Less than detection	Decreasing	Decreasing	Decreasing/flattening in 2004
KM-16	Off-Site Well	73.3	10	Mo, V	Less than detection	Decreasing	Flattening since 2003	Increasing since 2006
KM-17	Off-Site Well	48.2	10	Mo	Less than detection	No Trend	Decreasing	At detection
KM-18	Intermediate Depth Off-Site Well	172.6	20	Mo, V	Less than detection	Decreasing	Decreasing	Decreasing/flattening in 2004
KM-19	POC Deep Well	213.6	20	None	Less than detection	Decreasing	Flat	Flat

TABLE 3-1
MONITOR WELL EVALUATION TABLE

Well ID	Well Use	TPH/TBP	Well Located Within Plume?	ROD Clean-up Achieved?	Comment	Source Area Monitored
KM-1	Shallow Background	NA	NA	NA	Water level monitored	Lateral gradient background well - not sampled
KM-2	POC Well	NA	Yes	No	Seasonal COC fluctuation	Active calcine tailing impoundment/former scrubber pond area
KM-3	POC Well	NA	Yes	No	Seasonal COC fluctuation	Reclaimed scrubber pond
KM-4	Internal Facility Monitoring	NA	Yes	No		Active calcine tailing impoundment area
KM-5	POC Well	NA	Yes	No	Achieved Mo cleanup level	Historic scrubber pond/historic MAP ponds, Boiler blowdown pond/downgradient of facility
KM-6	Edge of Facility Monitoring	NA	Yes	No	Seasonal COC fluctuation	Historic Limestone Settling Ponds/Zone of large transmissivity
KM-7	Internal Facility Monitoring	NA	Yes	No		Historic calcine impoundment area
KM-8	POC Well	No trend	Yes	No	Seasonal COC fluctuation	Former S-X pond/ downgradient of plant facility
KM-9	POC Well	NA	Yes	No	Achieved Mo cleanup level	Former S-X pond/downgradient of plant facility
KM-10	Intermediate Depth Background	Not Sampled	NA	NA	Water level monitored	Intermediate depth background well

TABLE 3-1
MONITOR WELL EVALUATION TABLE

Well ID	Well Use	TPH/TBP	Well Located Within Plume?	ROD Clean-up Achieved?	Comment	Source Area Monitored
KM-11	Intermediate Depth POC Well	NA	No	No		Former scrubber pond
KM-12	Intermediate Depth POC Well	NA	Yes	No		Former S-X pond/ downgradient of plant facility
KM-13	POC Well	NA	Yes	No		Former S-X pond (north end) and downgradient of plant facility
KM-15	Off-Site Well	NA	Yes	No	Seasonal COC fluctuation	Off-site well southwest of former S-X pond and within main area of impacted ground water
KM-16	Off-Site Well	NA	Yes	No	Seasonal COC fluctuation	Off-site well south of former S-X and settling ponds and within main area of impacted ground water
KM-17	Off-Site Well	NA	No	No		Off-site well southwest of former scrubber pond and active calcine tailing
KM-18	Intermediate Depth Off-Site Well	NA	Yes	No	Seasonal COC fluctuation	Off-site well southwest of former S-X pond, pond and within main area of impacted ground water, paired with KM-15
KM-19	POC Deep Well	NA	No	Yes		Former S-X pond and downgradient of plant facility

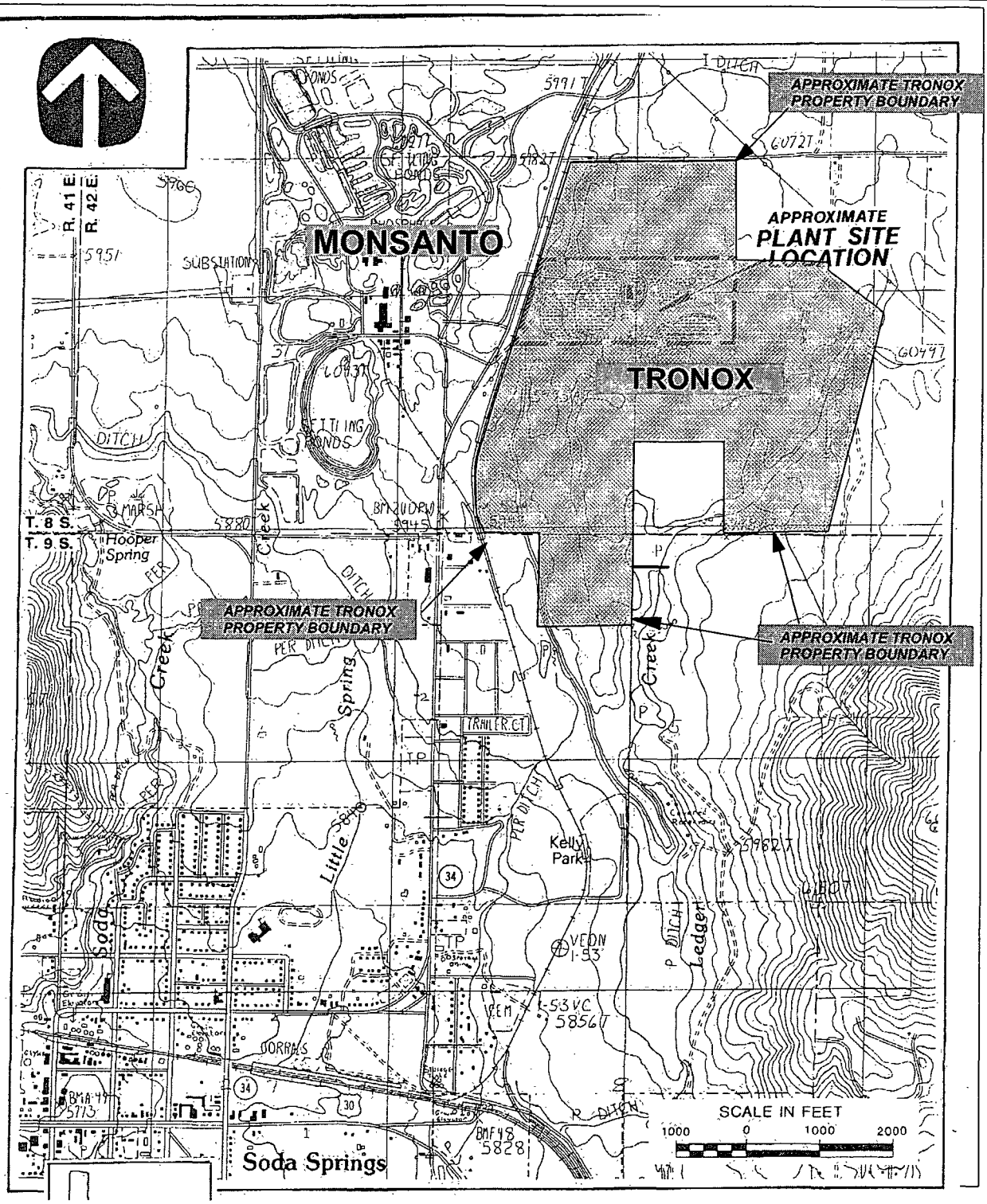
TABLE 3-2
LONG-TERM GROUND AND SURFACE MONITORING RECOMMENDATIONS

Well ID	Well/Spring Use	COC Exceeding RBC	ROD Clean-up Achieved?	Comment	Source Area Monitored	Recommended Long-Term Sampling Frequency
KM-1	Shallow Background	NA	NA	Water level monitored	Lateral gradient background well - not sampled	Water levels only
KM-2	POC Well	As, Mo, V	No	Seasonal COC fluctuation	Active calcine tailing impoundment/former scrubber pond area	Semiannual
KM-3	POC Well	As, Mn, Mo, V	No	Seasonal COC fluctuation	Reclaimed scrubber pond	Semiannual
KM-4	Internal Facility Monitoring	As, Mo, V	No		Active calcine tailing impoundment area	Semiannual
KM-5	POC Well	V	No	Achieved Mo cleanup level	Historic scrubber pond/historic MAP ponds, Boiler blowdown pond/downgradient of facility	Annual
KM-6	Edge of Facility Monitoring	As, Mo, V	No	Seasonal COC fluctuation	Historic Limestone Settling Ponds/Zone of large transmissivity	Semiannual
KM-7	Internal Facility Monitoring		No		Historic calcine impoundment area	Annual
KM-8	POC Well	As, Mn, Mo, V	No	Seasonal COC fluctuation	Former S-X pond/ downgradient of plant facility	Semiannual
KM-9	POC Well	V	No	Achieved Mo cleanup level	Former S-X pond/downgradient of plant facility	Annual
KM-10	Intermediate Depth Background	NA	NA	Water level monitored	Intermediate depth background well	Water levels only
KM-11	Intermediate Depth POC Well	Mo	No		Former scrubber pond	Semiannual

TABLE 3-2
LONG-TERM GROUND AND SURFACE MONITORING RECOMMENDATIONS

Well ID	Well/Spring Use	COC Exceeding RBC	ROD Clean-up Achieved?	Comment	Source Area Monitored	Recommended Long-Term Sampling Frequency
KM-12	Intermediate Depth POC Well	Mo, V	No		Former S-X pond/ downgradient of plant facility	Semiannual
KM-13	POC Well	Mo, V	No		Former S-X pond (north end) and downgradient of plant facility	Semiannual
KM-15	Off-Site Well	Mo, V	No	Seasonal COC fluctuation	Off-site well southwest of former S-X pond and within main area of impacted ground water	Semiannual
KM-16	Off-Site Well	Mo, V	No	Seasonal COC fluctuation	Off-site well south of former S-X and settling ponds and within main area of impacted ground water	Semiannual
KM-17	Off-Site Well	Mo	No		Off-site well southwest of former scrubber pond and active calcine tailing	Semiannual
KM-18	Intermediate Depth Off-Site Well	Mo, V	No	Seasonal COC fluctuation	Off-site well southwest of former S-X pond, pond and within main area of impacted ground water, paired with KM-15	Semiannual
KM-19	POC Deep Well	None	Yes		Former S-X pond and downgradient of plant facility	Annual
Upper Ledger	Water Supply	None			Downgradient of facility	Semiannual
Lower Ledger	Water Supply	None			Downgradient of facility	Semiannual
Finch Spring	Monitor off-site COC	Mo	No		Downgradient of facility	Semiannual
Big Spring	Monitor off-site COC	Mo	No		Downgradient of facility	Semiannual

FIGURES



MONITOR WELL NETWORK EVALUATION

APPROXIMATE TRONOX PROPERTY BOUNDARY LOCATION MAP

REFERENCE: U.S.G.S. QUADRANGLE SODA SPRINGS, IDAHO PROVISIONAL EDITION 1982.

SEE APPENDIX A FOR LEGAL DESCRIPTIONS

FIGURE 1-1

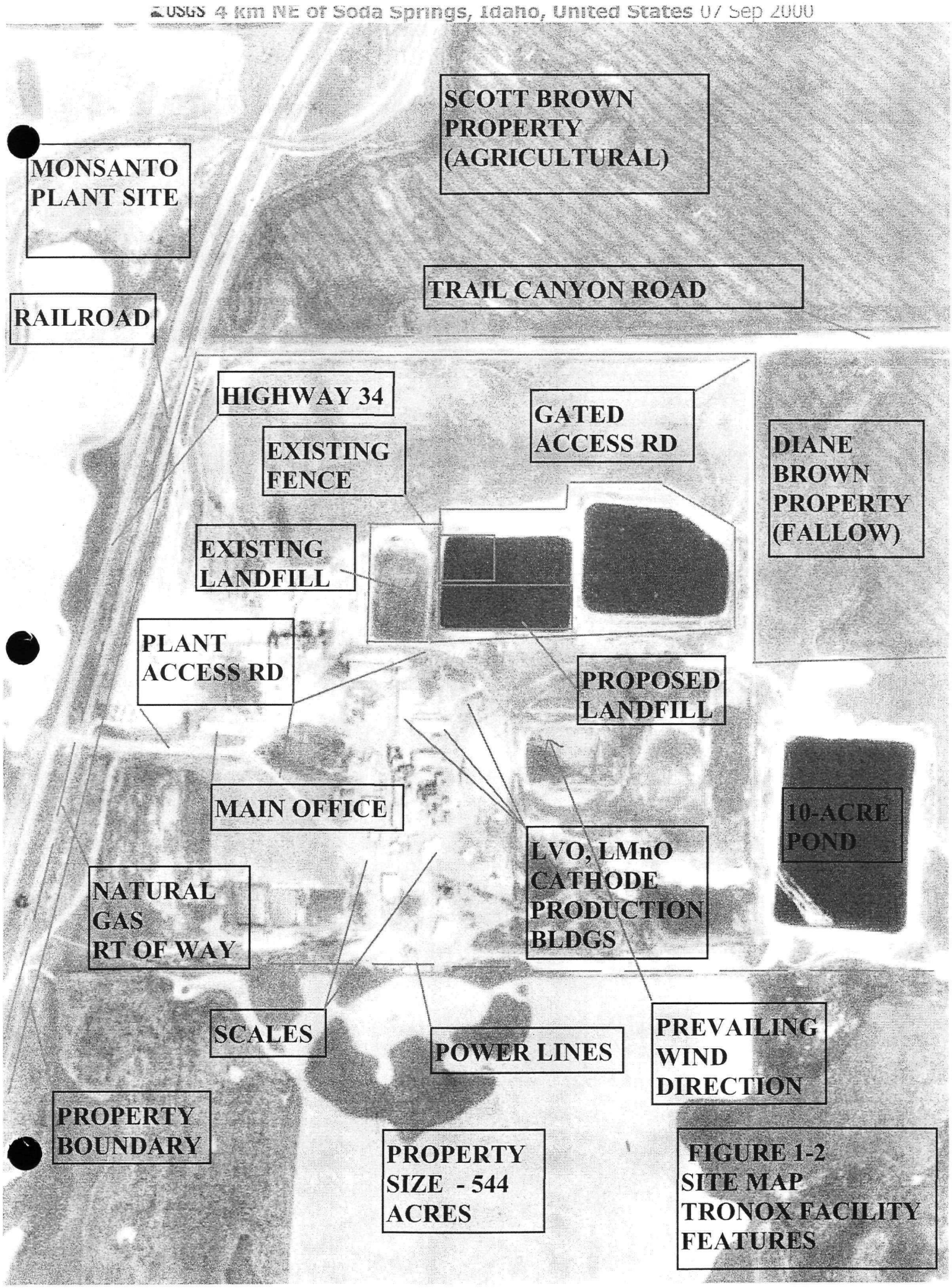
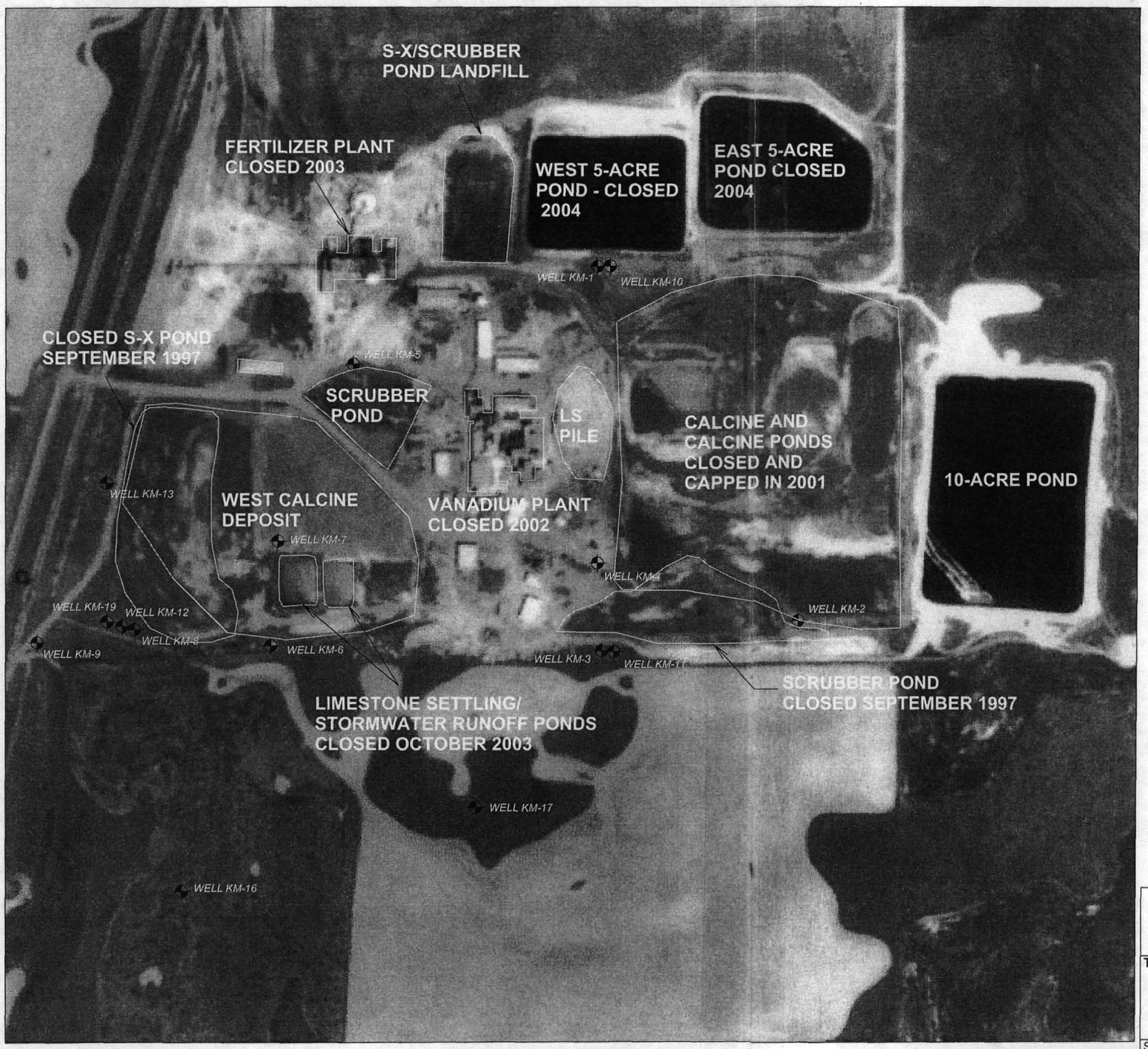


FIGURE 1-2
SITE MAP
TRONOX FACILITY
FEATURES



NORTH

0 200 400

MAP SCALE

REFERENCE: USGS TERRASERVER
DATE OF PHOTOGRAPHY SEPTEMBER 7, 2000

TRONOX SODA SPRINGS, IDAHO
GROUND WATER MONITORING NETWORK EVALUATION

TITLE

MONITOR WELLS, HISTORIC POND AND IMPOUNDMENT FEATURES

SIZE	CAGE CODE	DWG NO	REV
B			

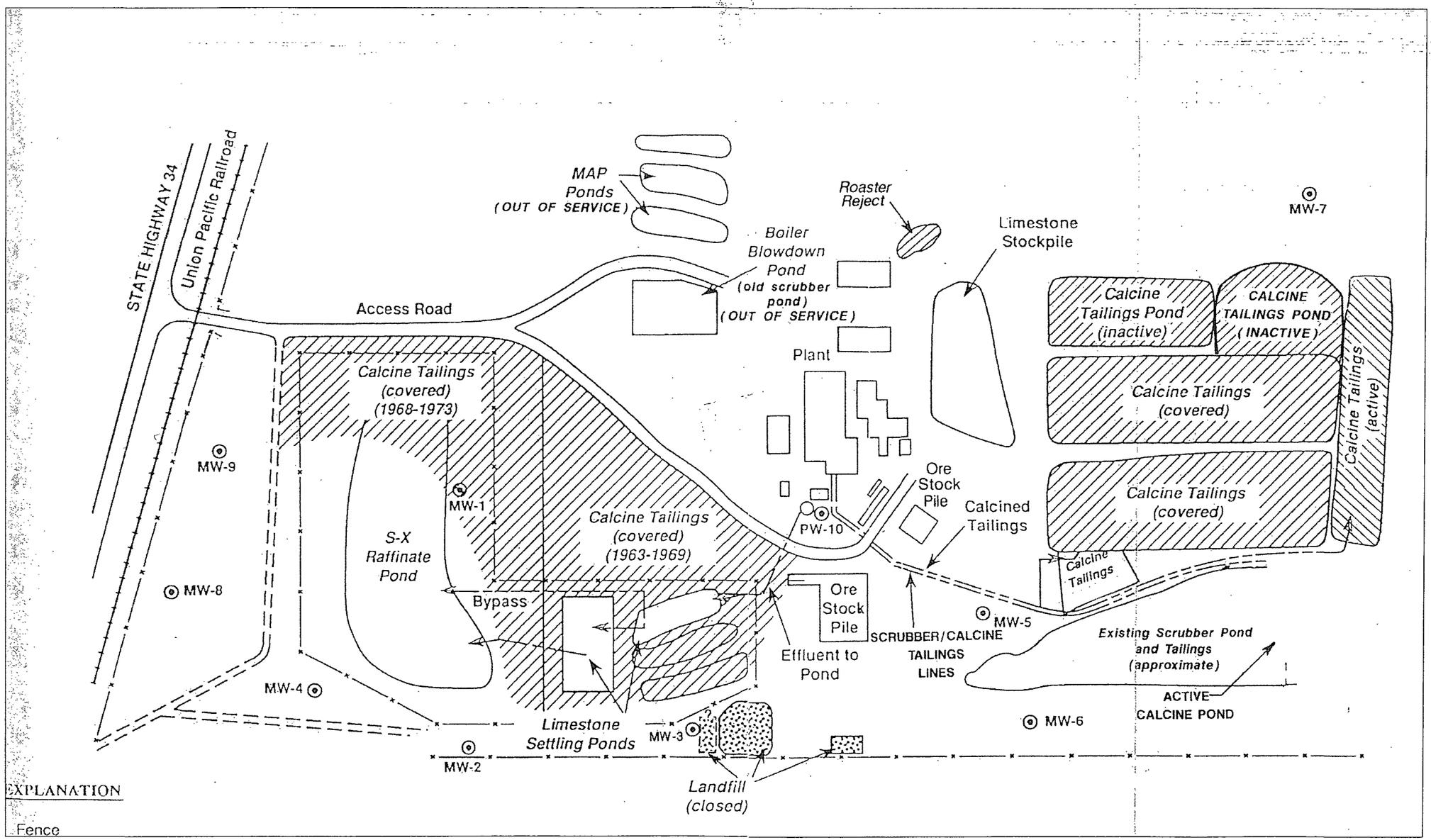
4/15/08

DRAWN BY J.S. BROWN, P.G.

SCALE

SHEET

FIGURE 1-3



REFERENCE: DAMES & MOORE, 1995

TRONOX SODA SPRINGS IDAHO
GROUND WATER MONITORING NETWORK EVALUATION

TITLE
HISTORIC SOLID SOURCES AND IMPOUNDMENTS

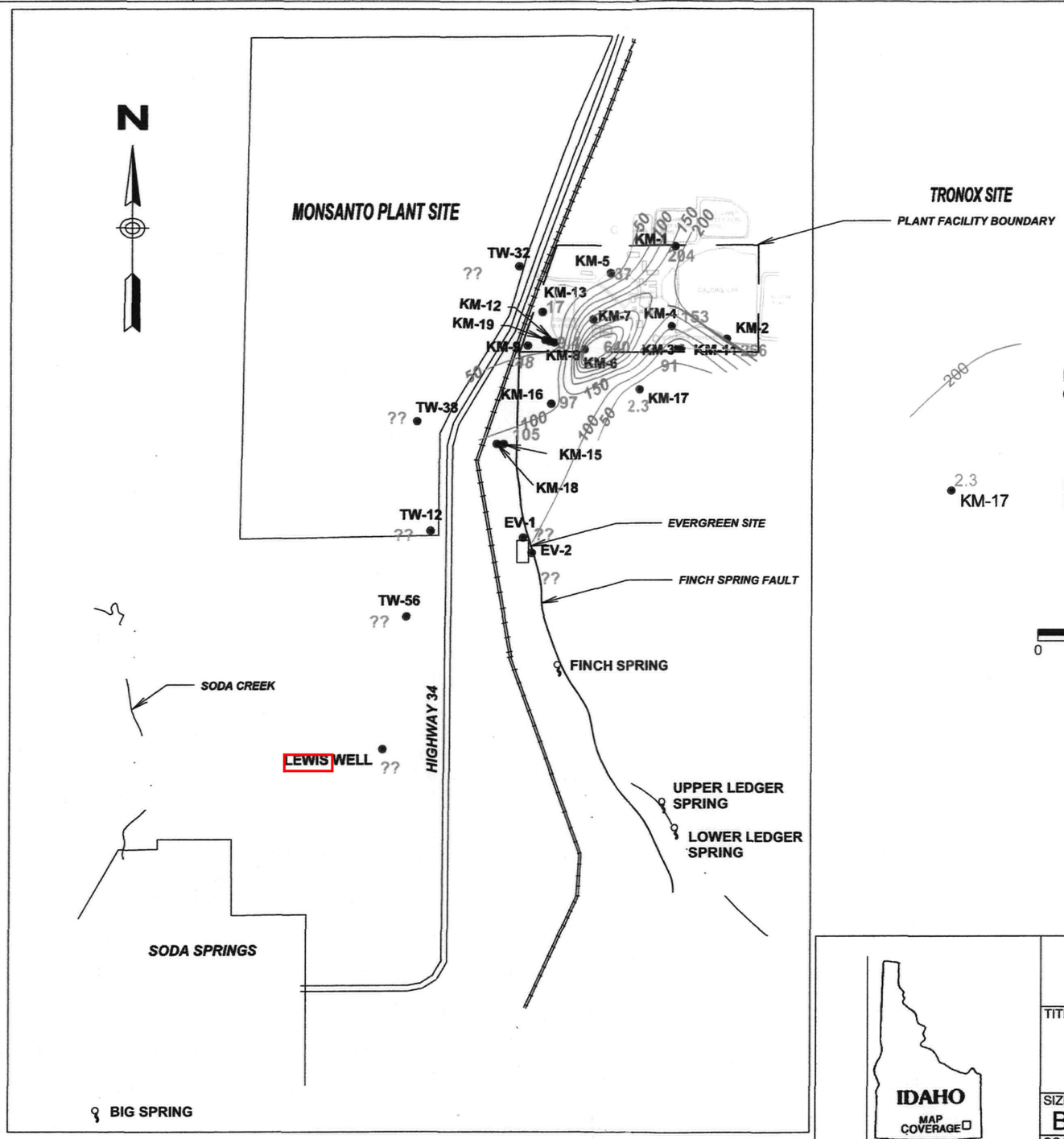
SIZE	CAGE CODE	DWG NO	REV
B			

4/14/08

DRAWN BY J.S. BROWN, P.G.

SCALE

SHEET FIGURE 1-4



KEY

INFERRED CONTOUR AND HYDRAULIC CONDUCTIVITY ISOPLETH

2.3 KM-17 — MONITOR WELL LOCATION AND ESTIMATED HYDRAULIC CONDUCTIVITY IN FEET/DAY

SCALE IN FEET

0 750 1500 3000

MONITOR WELL NETWORK EVALUATION

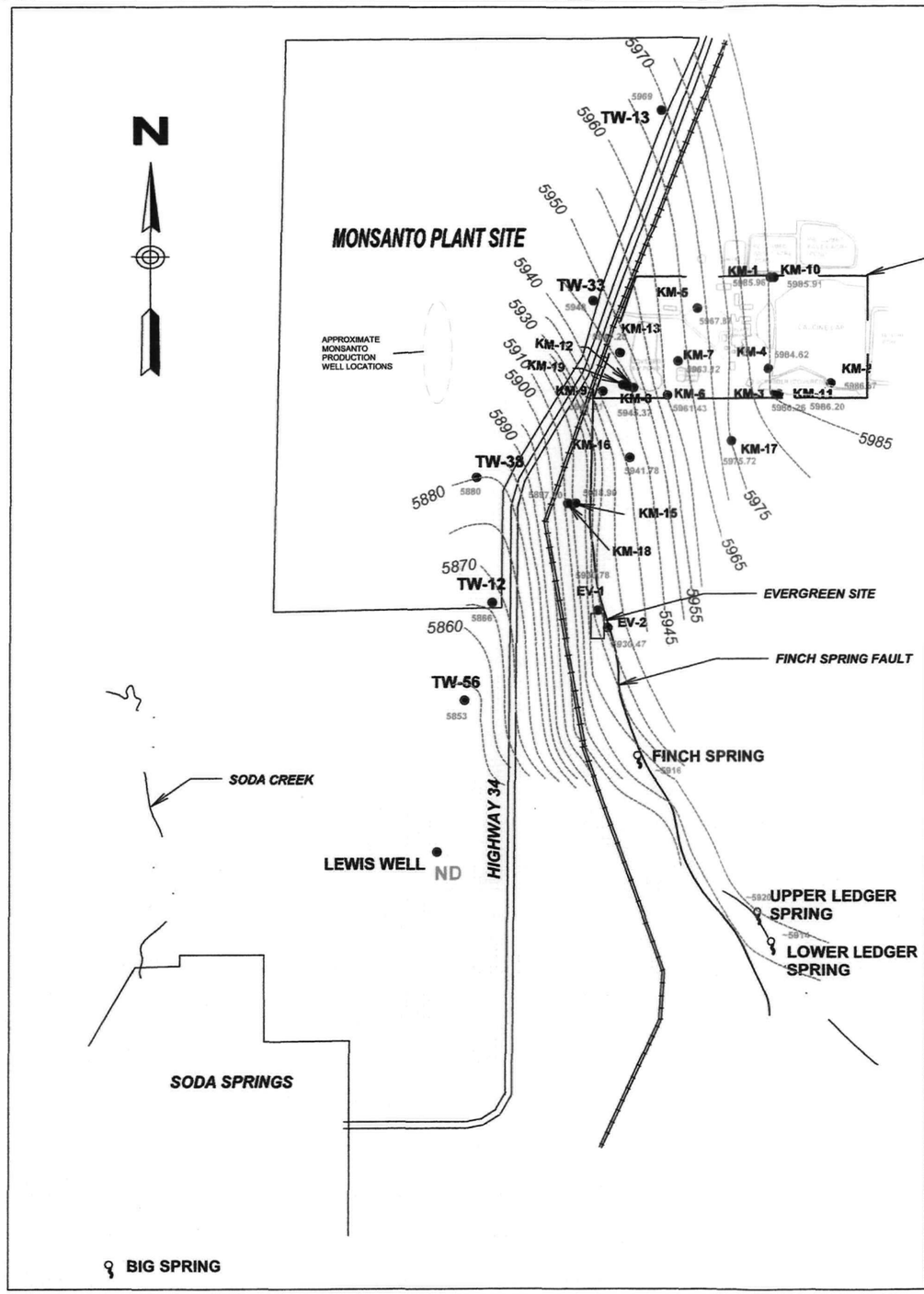
TITLE

DISTRIBUTION OF SHALLOW AQUIFER HYDRAULIC CONDUCTIVIY

SIZE	CAGE CODE	DWG NO	REV
B		WATERSAMPLELOCATIONS.TCW	0

SCALE AS SHOWN

SHEET FIGURE 2-1



KEY

5985 — INFERRED WATER LEVEL CONTOUR AND ELEVATION IN FEET

5975.72 KM-17 — MONITOR WELL LOCATION AND WATER LEVEL ELEVATION

SCALE IN FEET

0 750 1500 3000

NOTES:

CONTOURS ARE BASED ON WATER LEVELS IN SHALLOW AQUIFER.

MONITOR WELL NETWORK EVALUATION

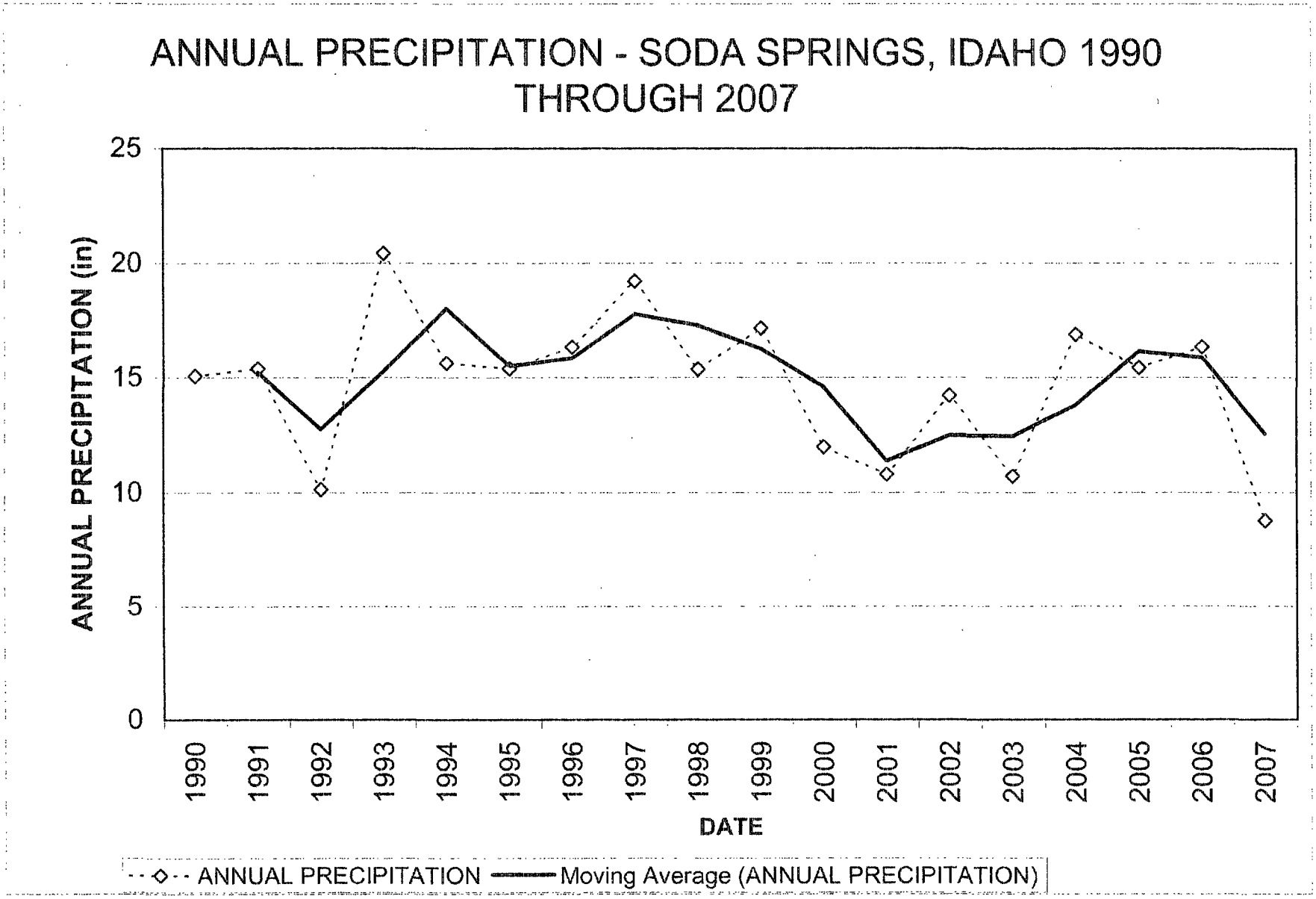
TITLE

CONTOUR OF GROUND WATER LEVEL ELEVATIONS - MAY 2007

SIZE	CAGE CODE	DWG NO	REV
B		WATERSAMPLELOCATIONS.TCW	0

SCALE AS SHOWN

SHEET **FIGURE 3-1**


ANNUAL PRECIPITATION - SODA SPRINGS, IDAHO 1990 THROUGH 2007
ANNUAL PRECIPITATION (in)
25
20
15
10
5
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
DATE
ANNUAL PRECIPITATION
Moving Average (ANNUAL PRECIPITATION)

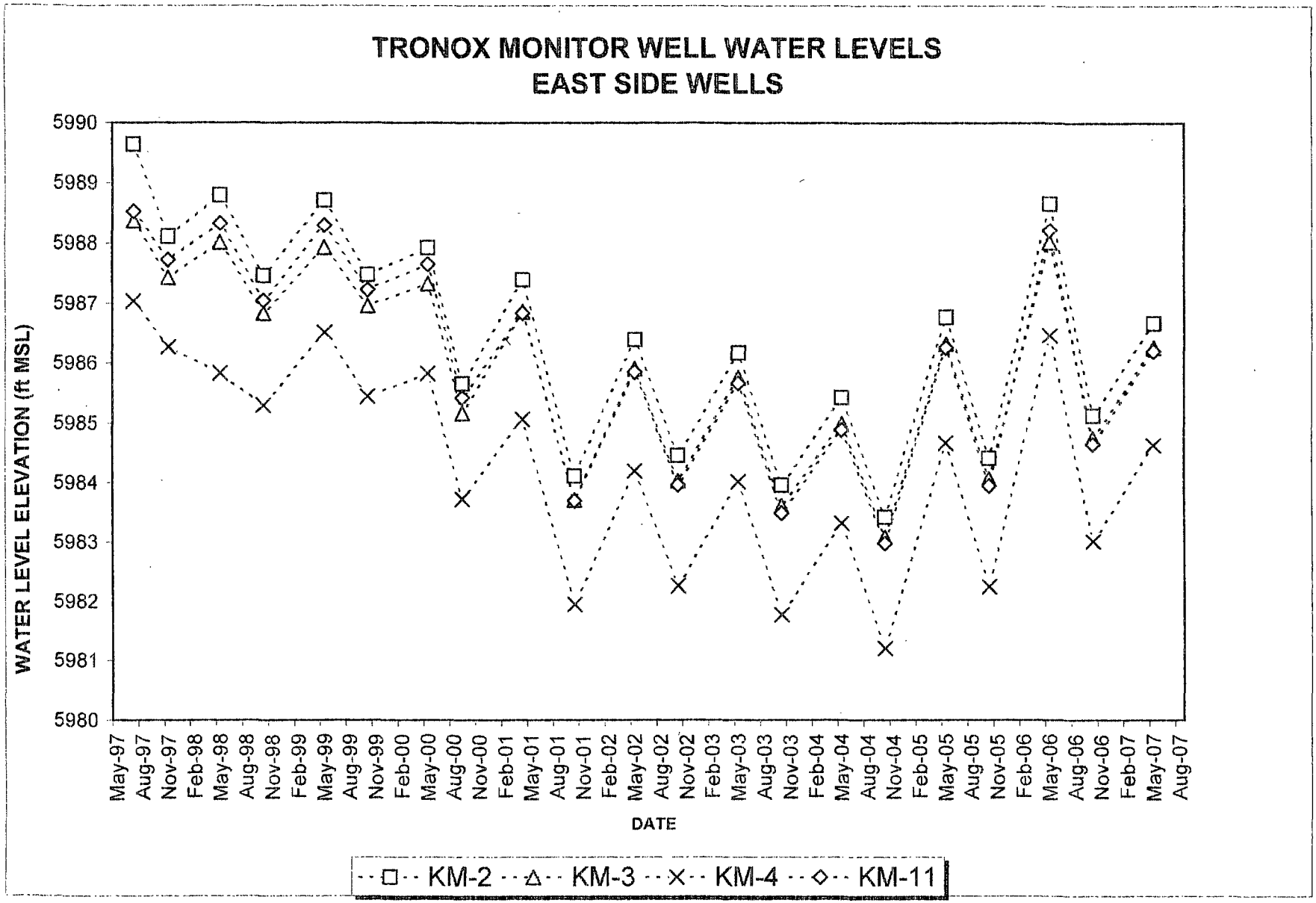

TRONOX MONITOR WELL WATER LEVELS
EAST SIDE WELLS
WATER LEVEL ELEVATION (ft MSL)
5990
5989
5988
5987
5986
5985
5984
5983
5982
5981
5980
May-97
Aug-97
Nov-97
Feb-98
May-98
Aug-98
Nov-98
Feb-99
May-99
Aug-99
Nov-99
Feb-00
May-00
Aug-00
Nov-00
Feb-01
May-01
Aug-01
Nov-01
Feb-02
May-02
Aug-02
Nov-02
Feb-03
May-03
Aug-03
Nov-03
Feb-04
May-04
Aug-04
Nov-04
Feb-05
May-05
Aug-05
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Aug-07
DATE
KM-2
KM-3
KM-4
KM-11

FIGURE 3-3

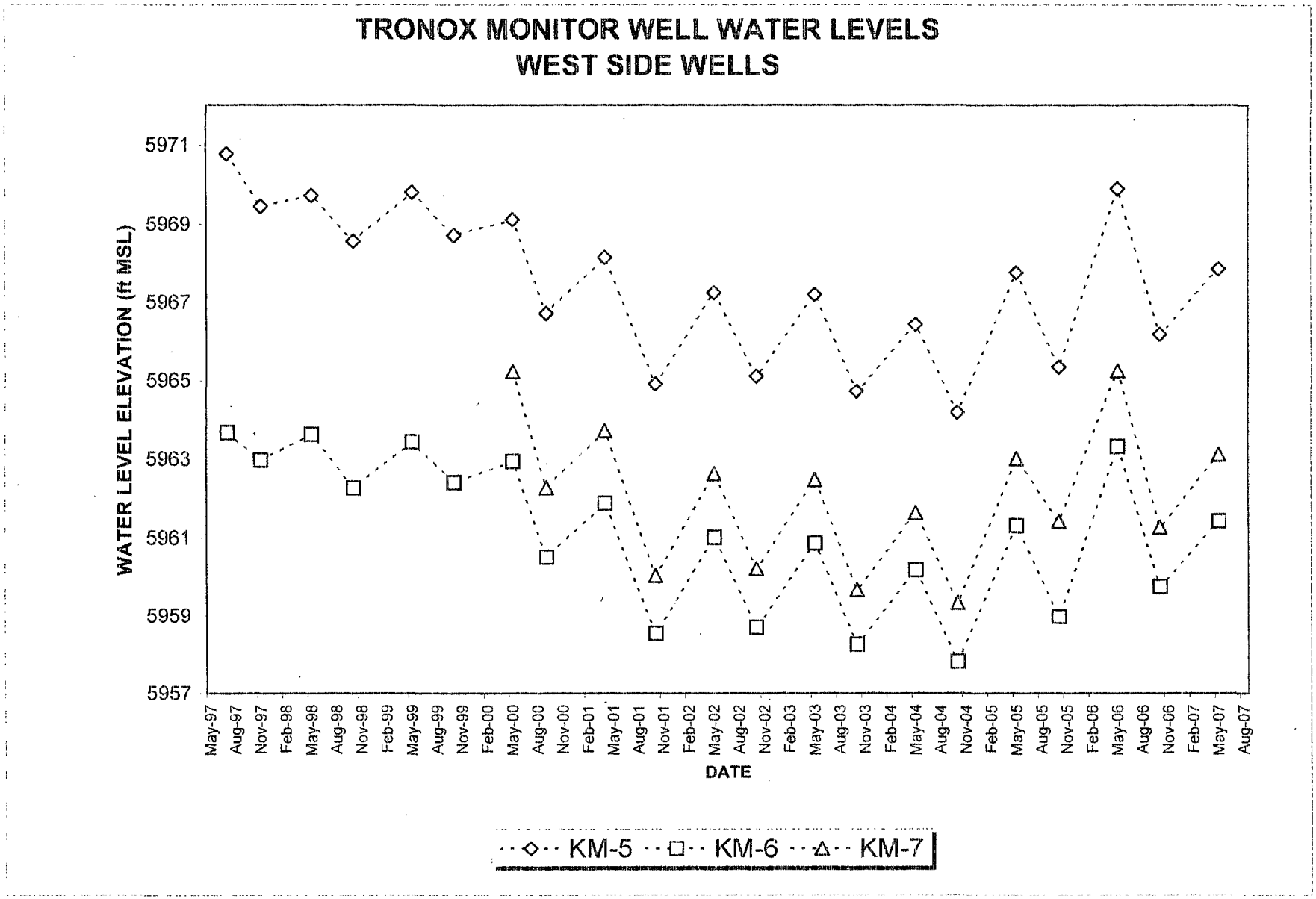

TRONOX MONITOR WELL WATER LEVELS
WEST SIDE WELLS
WATER LEVEL ELEVATION (ft MSL)
5971
5969
5967
5965
5963
5961
5959
5957
May-97
Aug-97
Nov-97
Feb-98
May-98
Aug-98
Nov-98
Feb-99
May-99
Aug-99
Nov-99
Feb-00
May-00
Aug-00
Nov-00
Feb-01
May-01
Aug-01
Nov-01
Feb-02
May-02
Aug-02
Nov-02
Feb-03
May-03
Aug-03
Nov-03
Feb-04
May-04
Aug-04
Nov-04
Feb-05
May-05
Aug-05
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Aug-07
DATE
KM-5
KM-6
KM-7

FIGURE 3-4

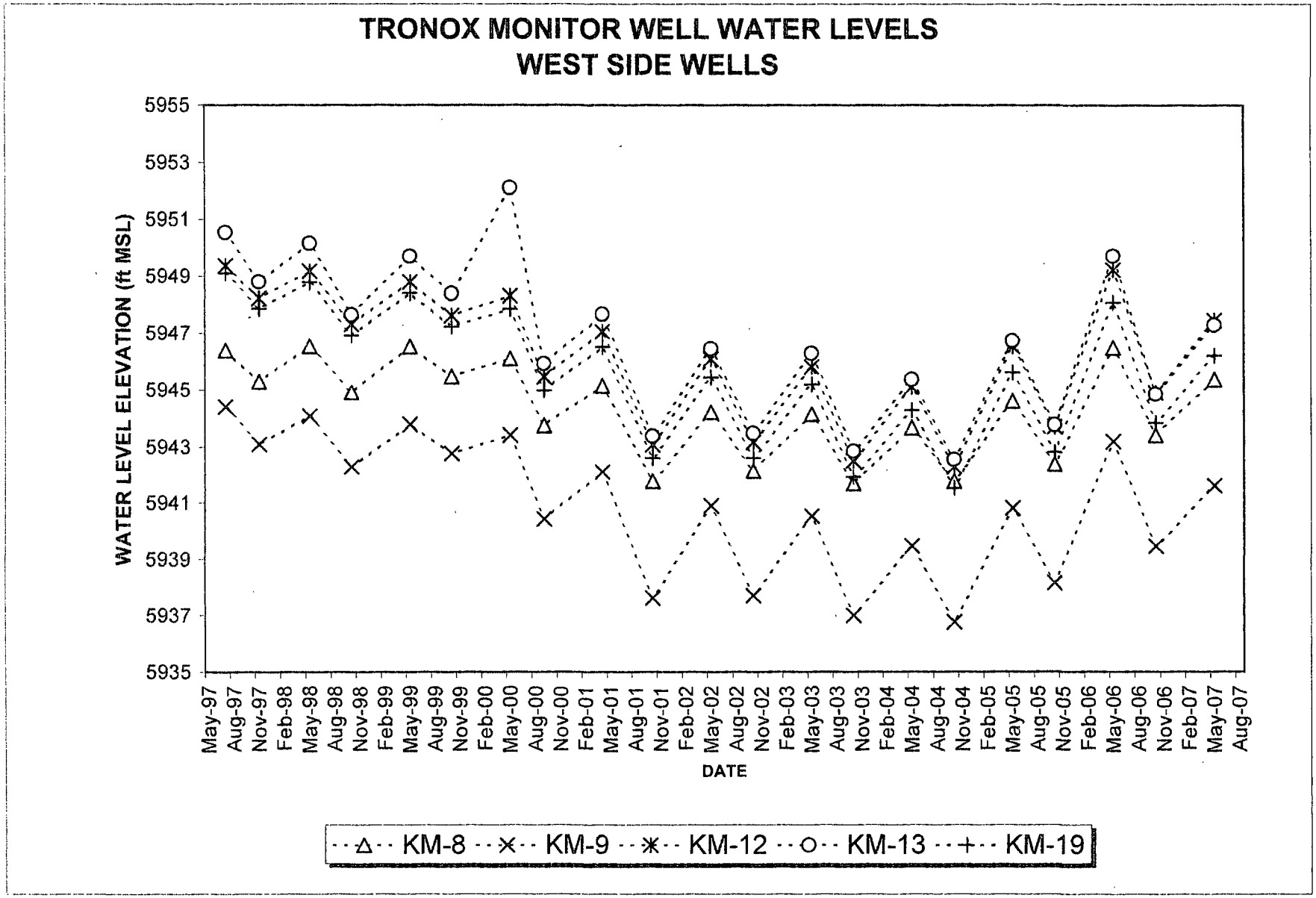

TRONOX MONITOR WELL WATER LEVELS
WEST SIDE WELLS
WATER LEVEL ELEVATION (ft MSL)
5955
5953
5951
5949
5947
5945
5943
5941
5939
5937
5935
May-97
Aug-97
Nov-97
Feb-98
May-98
Aug-98
Nov-98
Feb-99
May-99
Aug-99
Nov-99
Feb-00
May-00
Aug-00
Nov-00
Feb-01
May-01
Aug-01
Nov-01
Feb-02
May-02
Aug-02
Nov-02
Feb-03
May-03
Aug-03
Nov-03
Feb-04
May-04
Aug-04
Nov-04
Feb-05
May-05
Aug-05
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Aug-07
DATE
KM-8
KM-9
KM-12
KM-13
KM-19

FIGURE 3-5

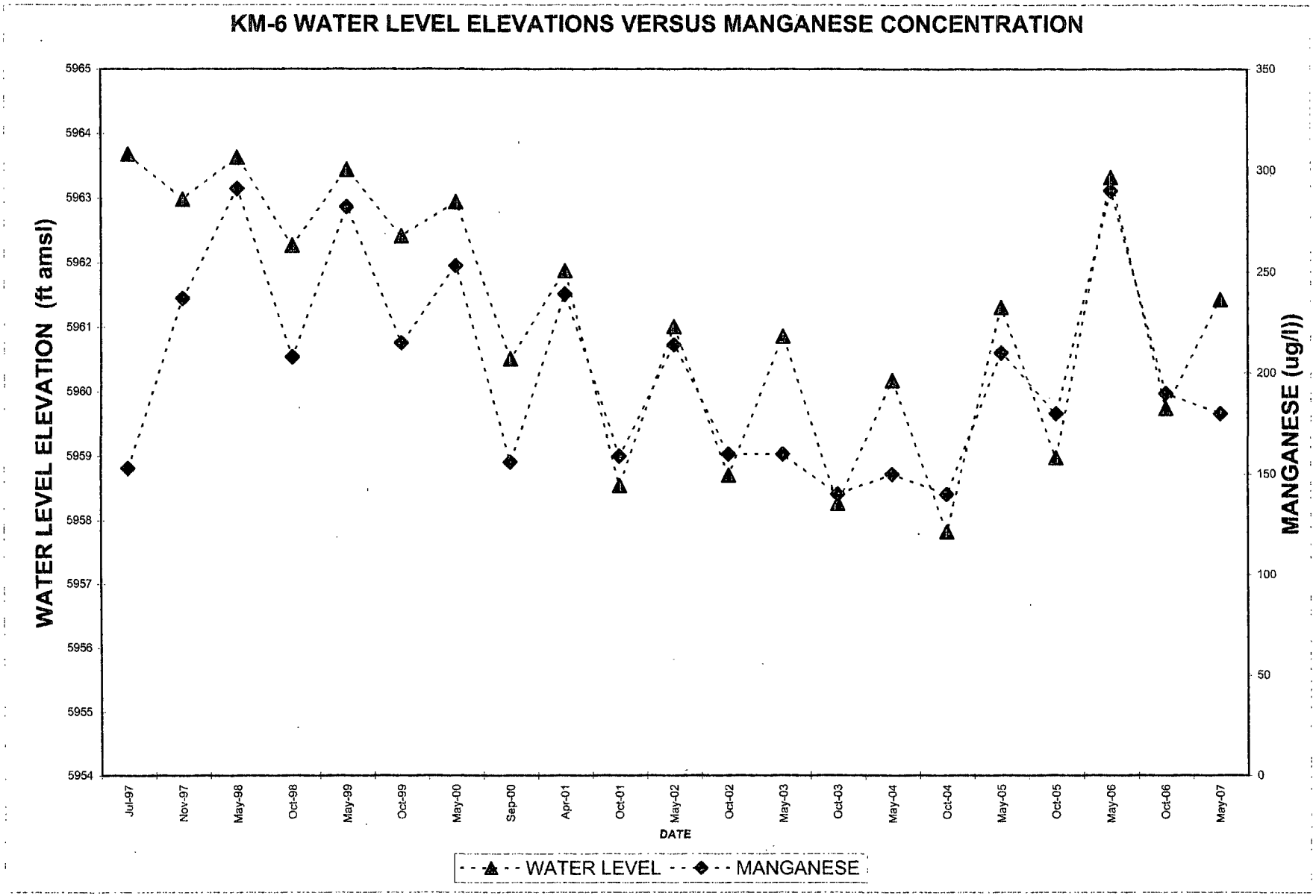

KM-6 WATER LEVEL ELEVATIONS VERSUS MANGANESE CONCENTRATION
WATER LEVEL ELEVATION (ft amsl)
MANGANESE (ug/l))
5965
5964
5963
5962
5961
5960
5959
5958
5957
5956
5955
5954
350
300
250
200
150
100
50
0
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
WATER LEVEL
MANGANESE

FIGURE 3-6

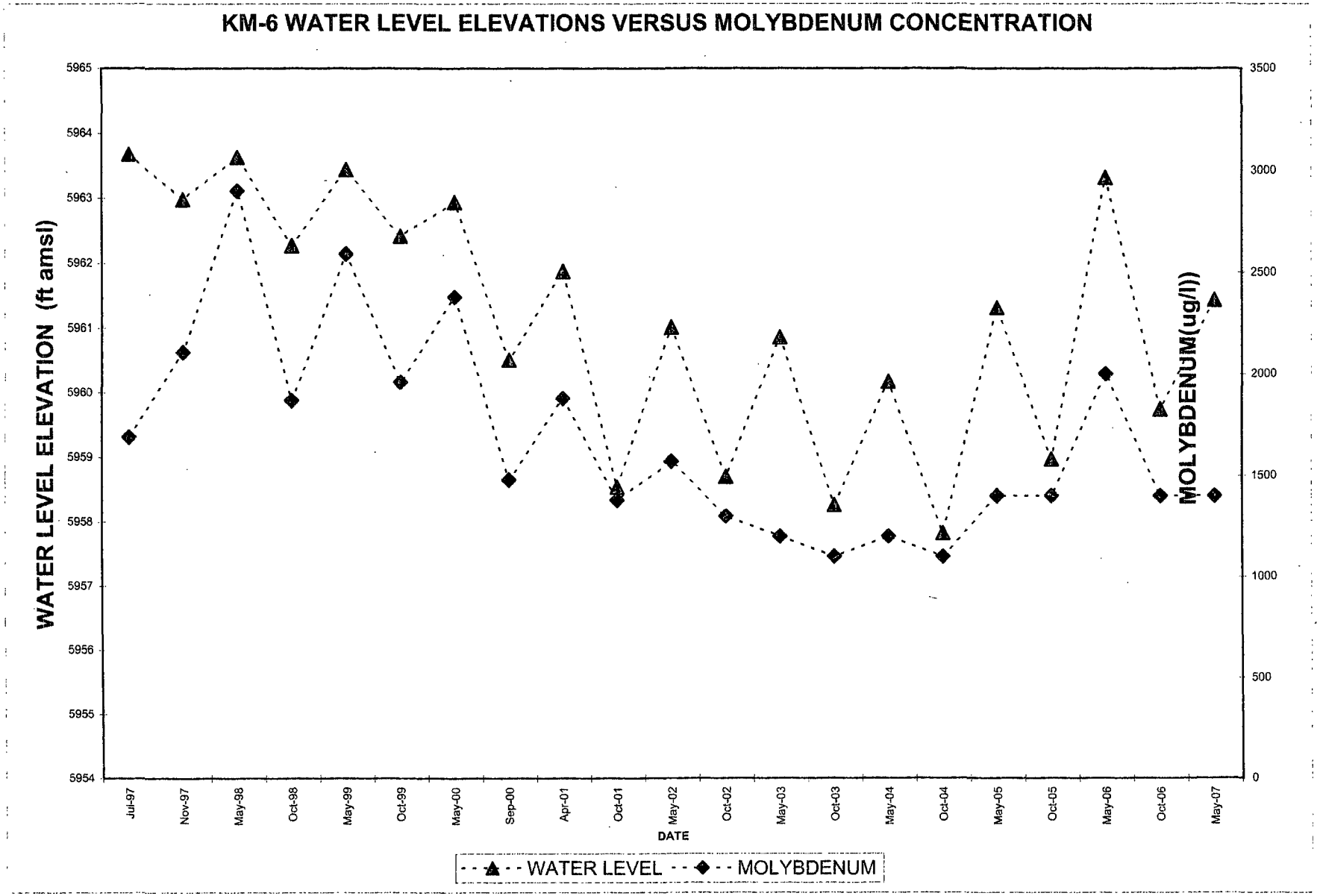

KM-6 WATER LEVEL ELEVATIONS VERSUS MOLYBDENUM CONCENTRATION
WATER LEVEL ELEVATION (ft amsl)
MOLYBDENUM(ug/l))
5965
5964
5963
5962
5961
5960
5959
5958
5957
5956
5955
5954
3500
3000
2500
2000
1500
1000
500
0
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
WATER LEVEL
MOLYBDENUM

FIGURE 3-7

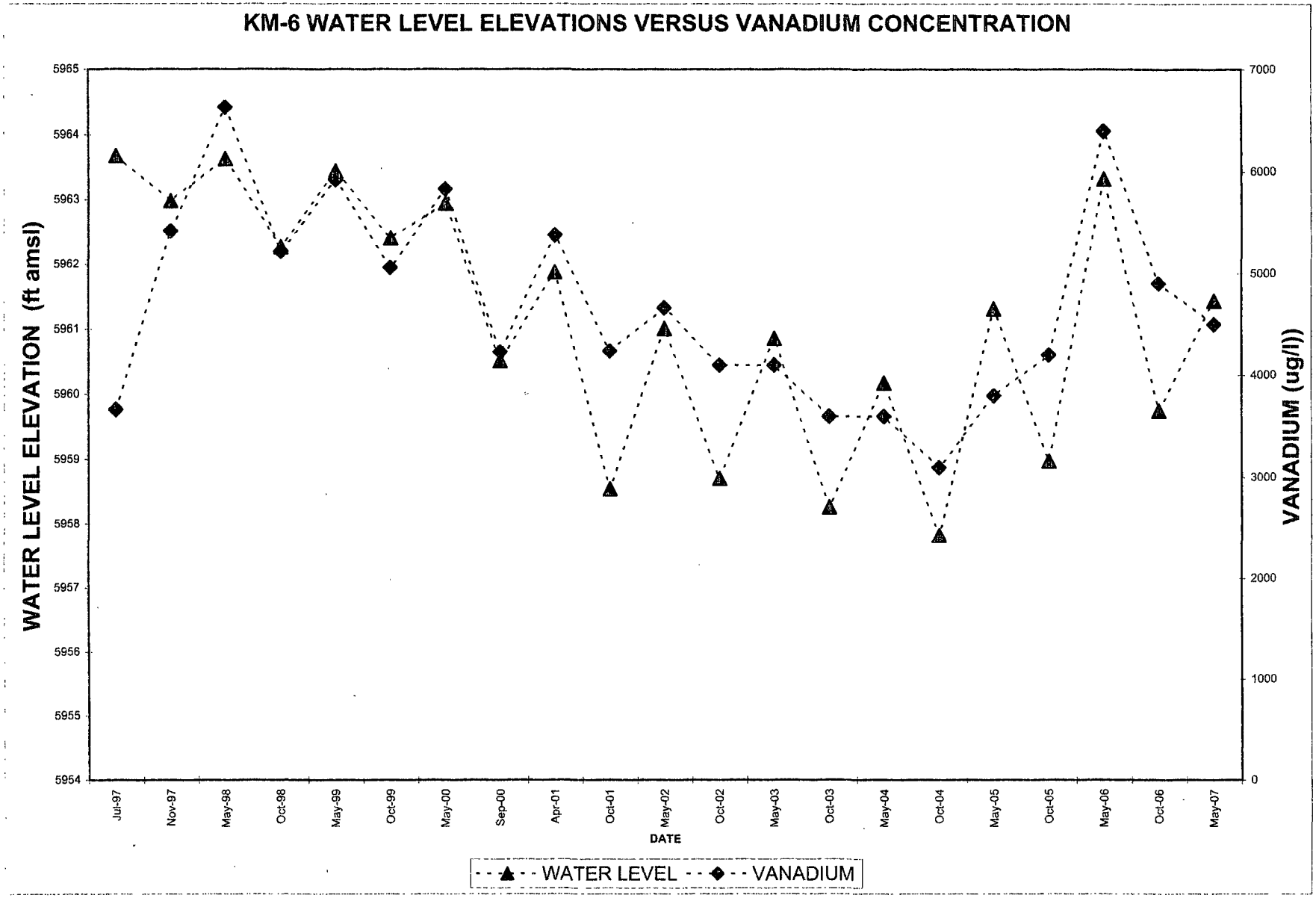

KM-6 WATER LEVEL ELEVATIONS VERSUS VANADIUM CONCENTRATION
WATER LEVEL ELEVATION (ft amsl)
VANADIUM (ug/l))
5965
5964
5963
5962
5961
5960
5959
5958
5957
5956
5955
5954
7000
6000
5000
4000
3000
2000
1000
0
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
WATER LEVEL
VANADIUM

FIGURE 3-8

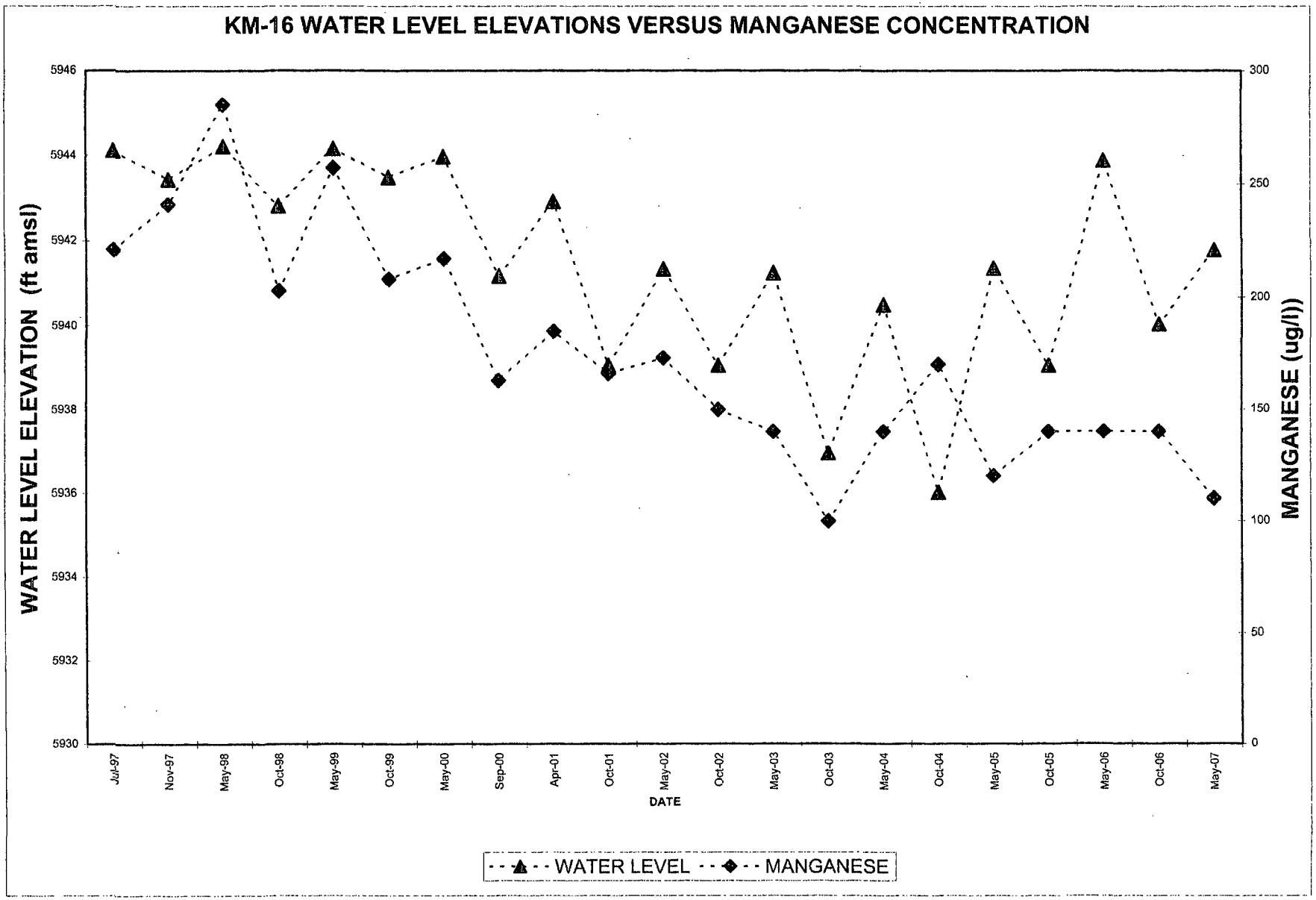

KM-16 WATER LEVEL ELEVATIONS VERSUS MANGANESE CONCENTRATION
WATER LEVEL ELEVATION (ft amsl)
MANGANESE (ug/l))
5946
5944
5942
5940
5938
5936
5934
5932
5930
300
250
200
150
100
50
0
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
WATER LEVEL
MANGANESE

FIGURE 3-9

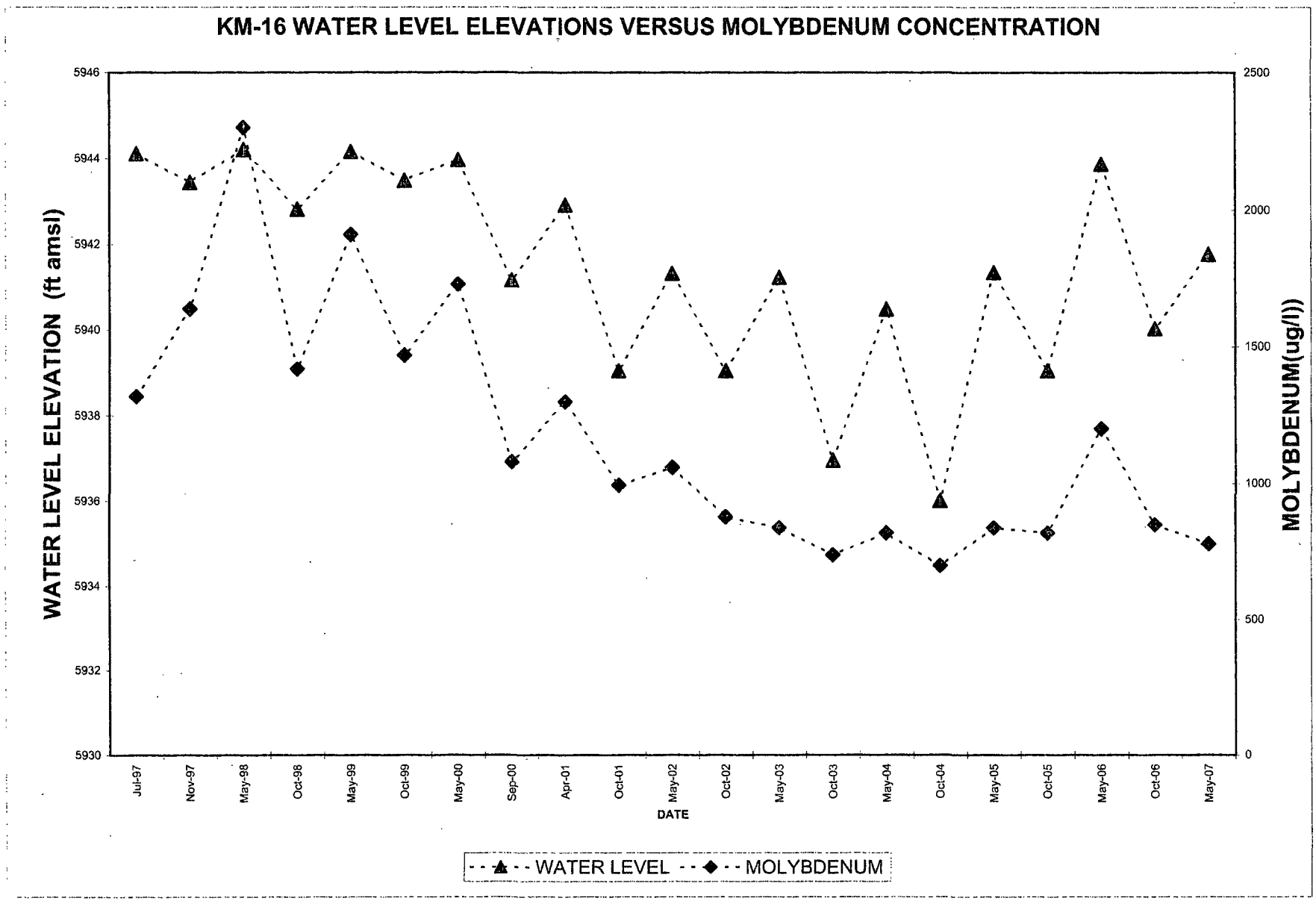

KM-16 WATER LEVEL ELEVATIONS VERSUS MOLYBDENUM CONCENTRATION
WATER LEVEL ELEVATION (ft amsl)
MOLYBDENUM(ug/l))
5946
5944
5942
5940
5938
5936
5934
5932
5930
2500
2000
1500
1000
500
0
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
WATER LEVEL
MOLYBDENUM

FIGURE 3-10

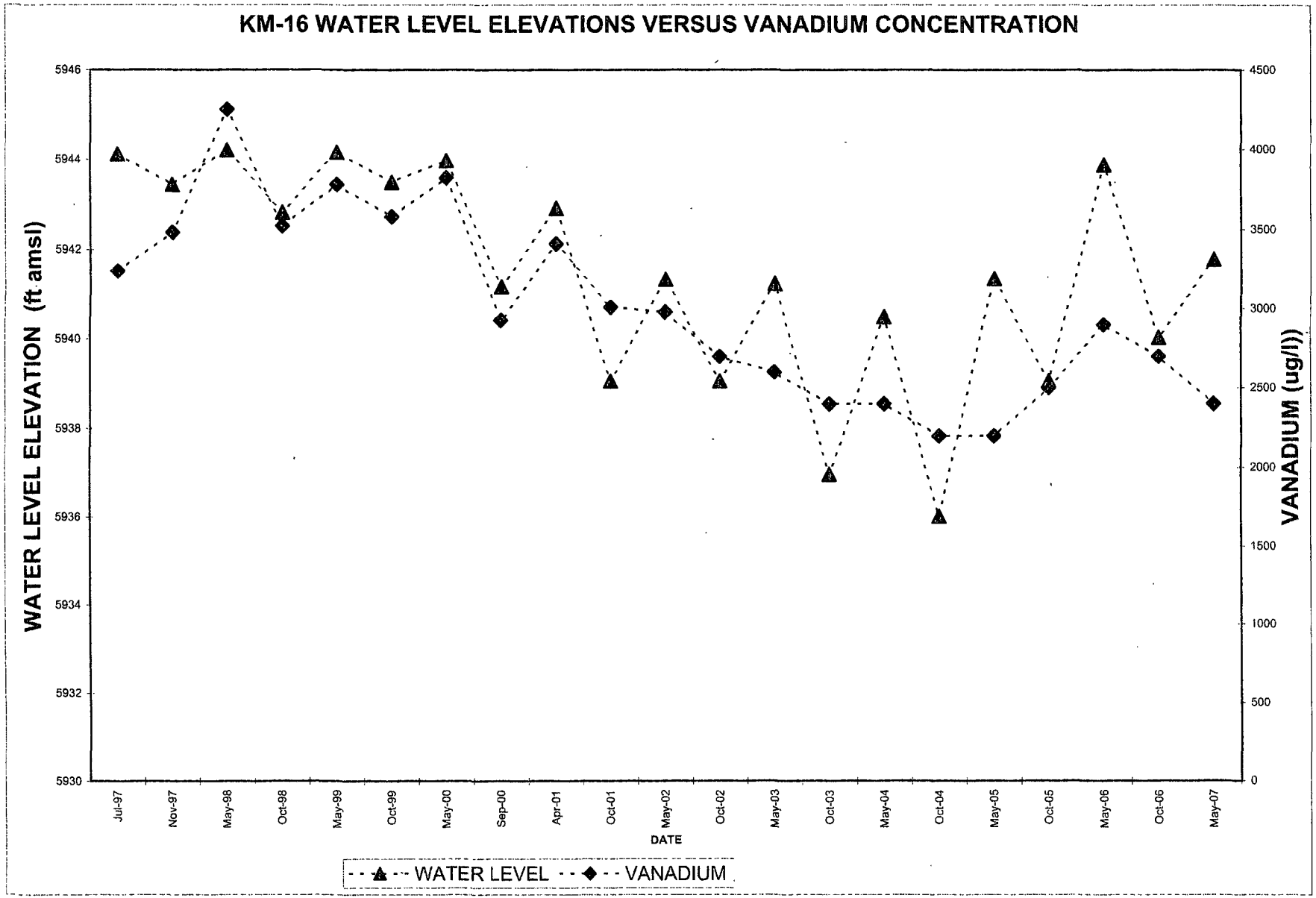
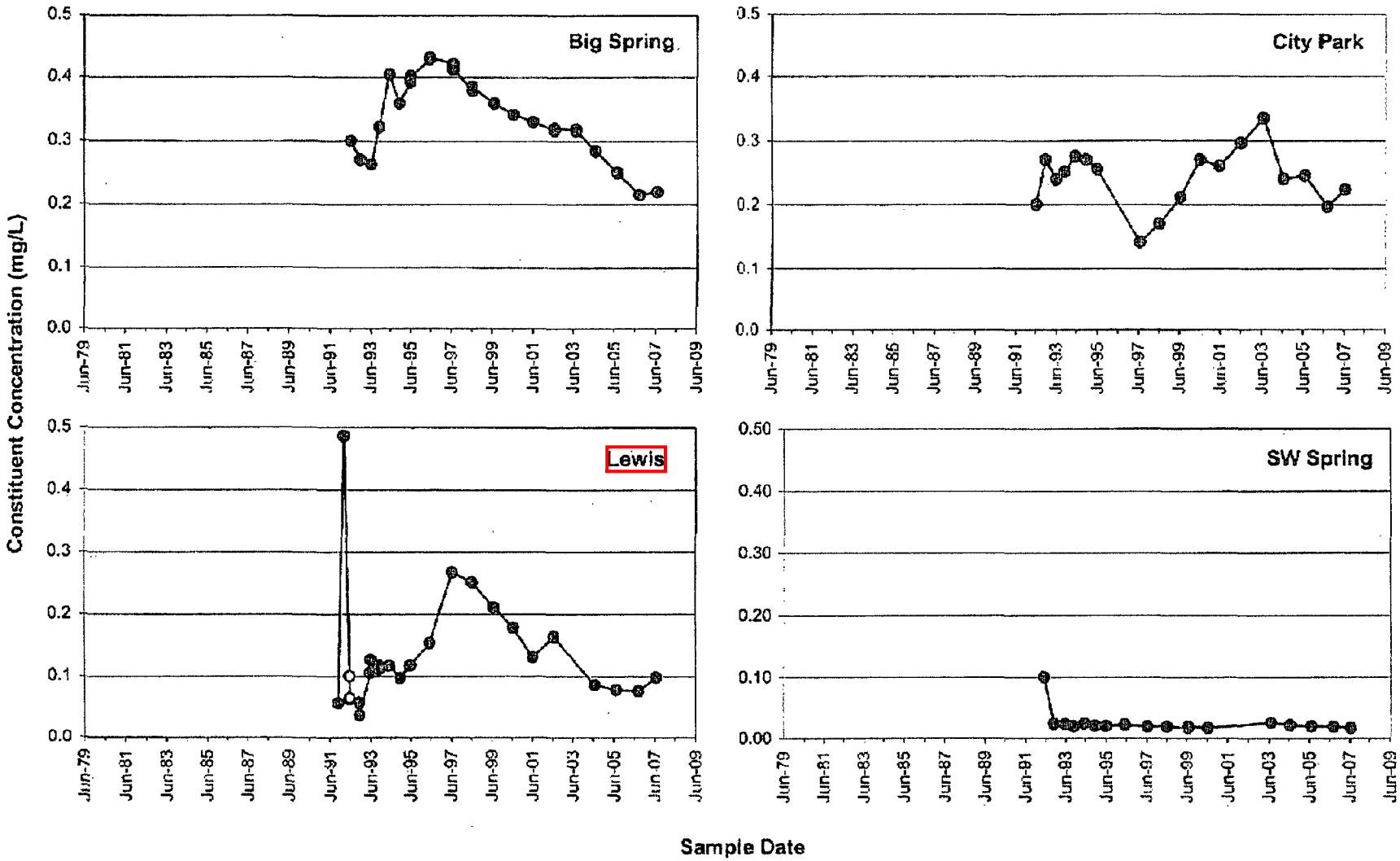

KM-16 WATER LEVEL ELEVATIONS VERSUS VANADIUM CONCENTRATION
WATER LEVEL ELEVATION (ft amsl)
VANADIUM (ug/l))
5946
5944
5942
5940
5938
5936
5934
5932
5930
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
WATER LEVEL
VANADIUM

FIGURE 3-11



FILE NAME App G.Molybdenum Charts 2007 x s

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Molybdenum in Offsite Wells and Springs**

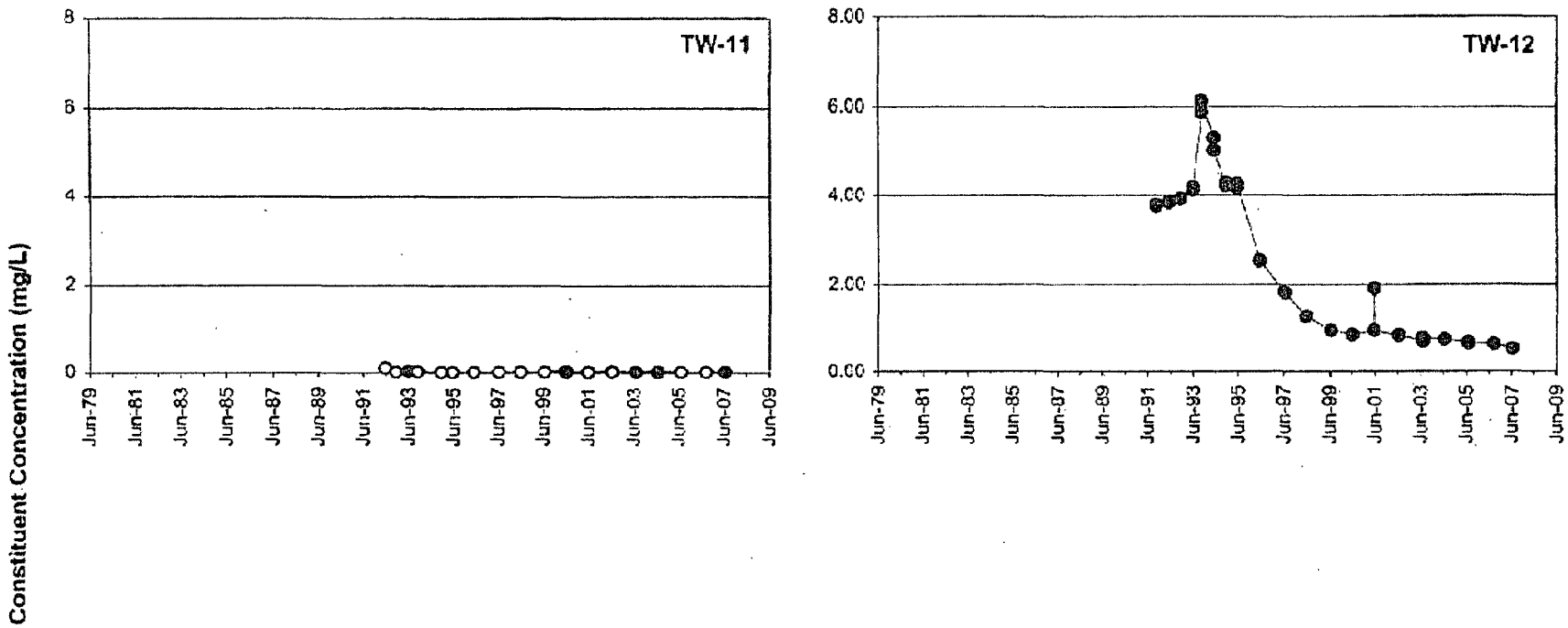
FIGURE G-14

—◆— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB

FIGURE 3-12



Sample Date

FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Molybdenum in Southeast Corner Wells**

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company		
PROJECT	Monsanto Groundwater Monitoring		
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	

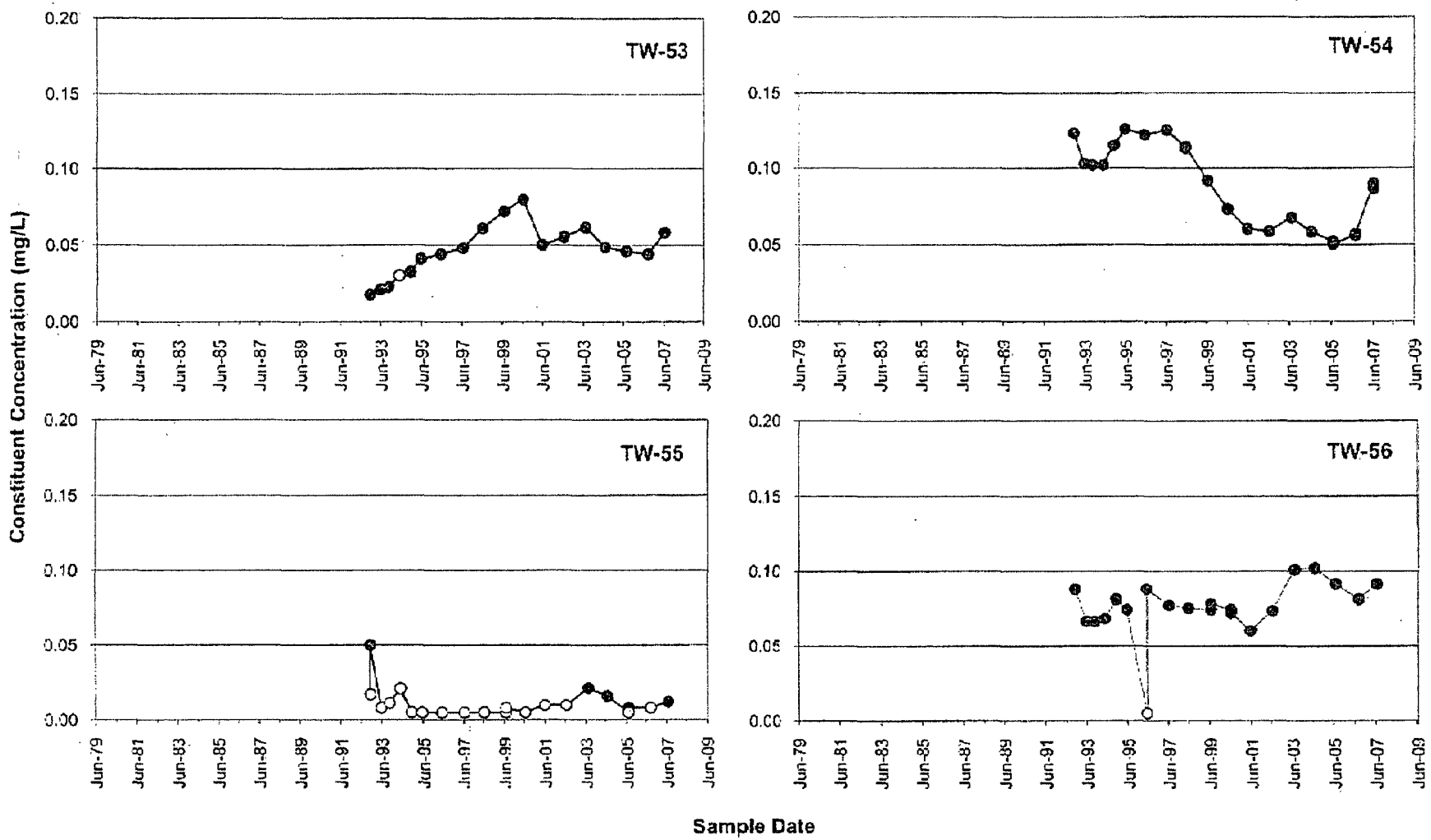
FIGURE G-11

DRAWN DH

CHECKED MPK

REVIEWED DB

FIGURE 3-13



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Molybdenum in Southern Boundary Wells**

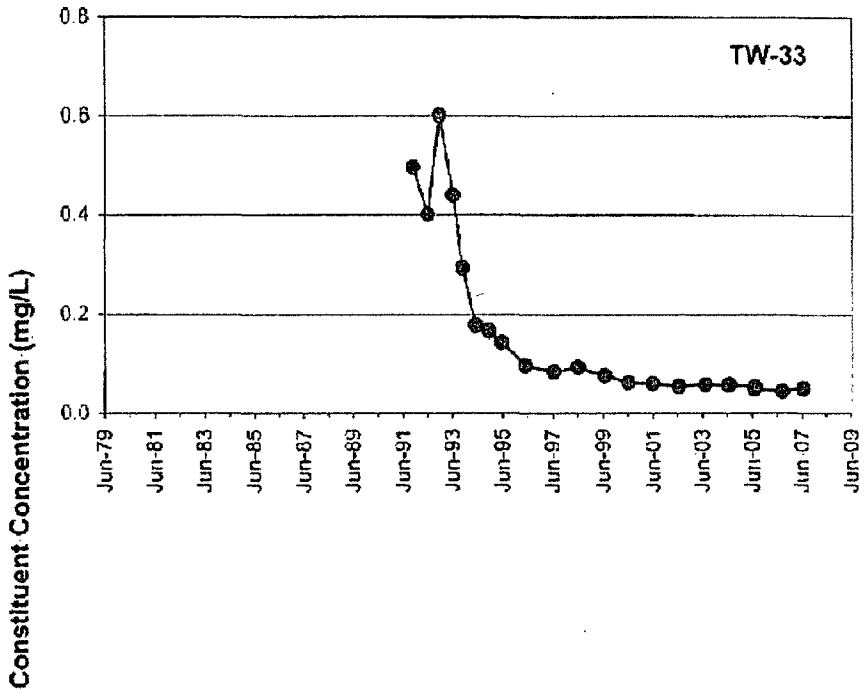
FIGURE G-3

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB

FIGURE 3-14



Sample Date

FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates	TITLE: Molybdenum in East Wells		FIGURE G-13
—●— Constituent Concentration (mg/L)	CLIENT: Monsanto Company		DRAWN: DH
	PROJECT: Monsanto Groundwater Monitoring		CHECKED: MPK
	PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED: DB

FIGURE 3-15

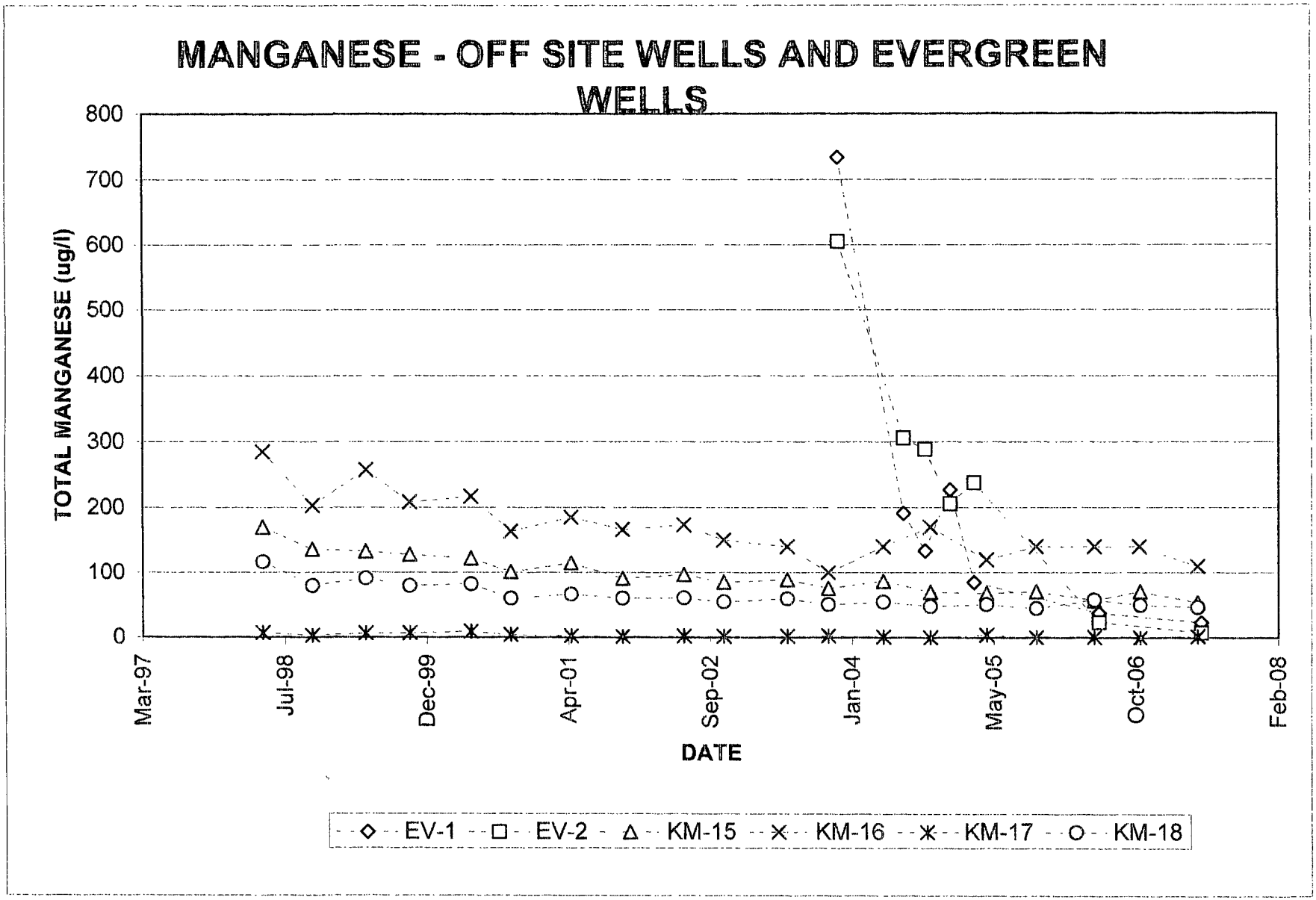

MANGANESE - OFF SITE WELLS AND EVERGREEN WELLS
TOTAL MANGANESE (ug/l)
800
700
600
500
400
300
200
100
0
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
DATE
EV-1
EV-2
KM-15
KM-16
KM-17
KM-18

FIGURE 3-16

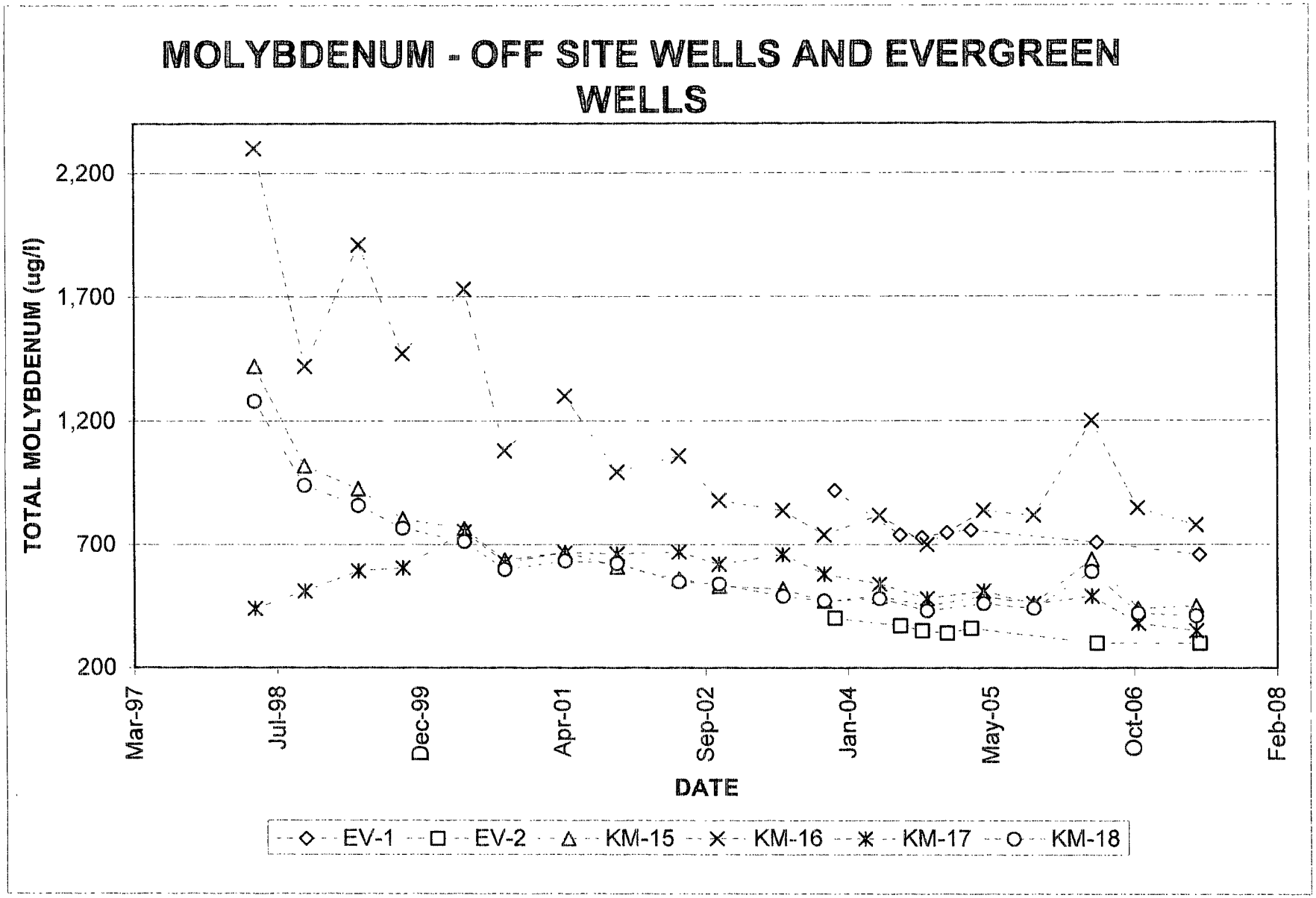

MOLYBDENUM - OFF SITE WELLS AND EVERGREEN WELLS
TOTAL MOLYBDENUM (ug/l)
2,200
1,700
1,200
700
200
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
DATE
EV-1
EV-2
KM-15
KM-16
KM-17
KM-18

FIGURE 3-17

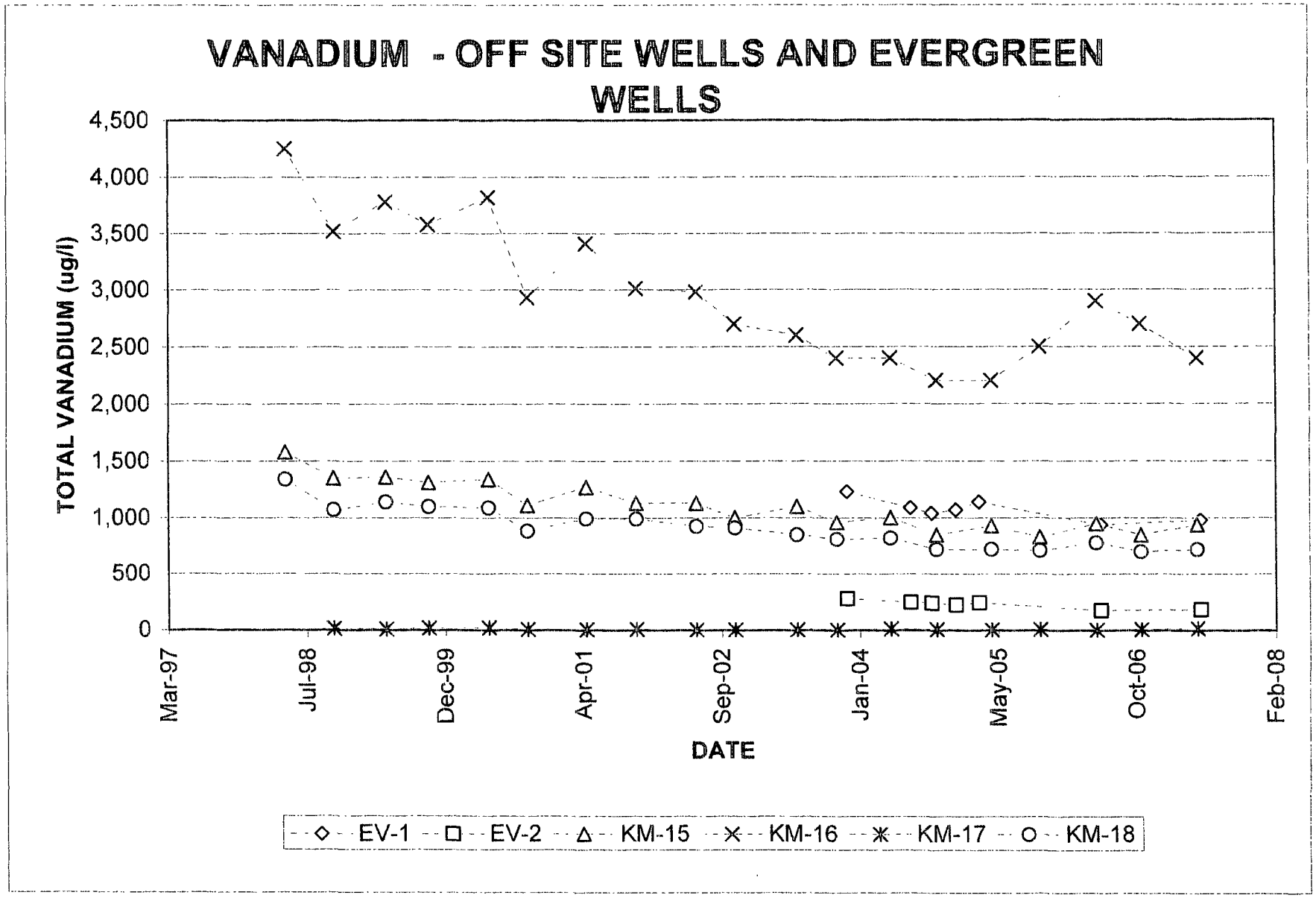
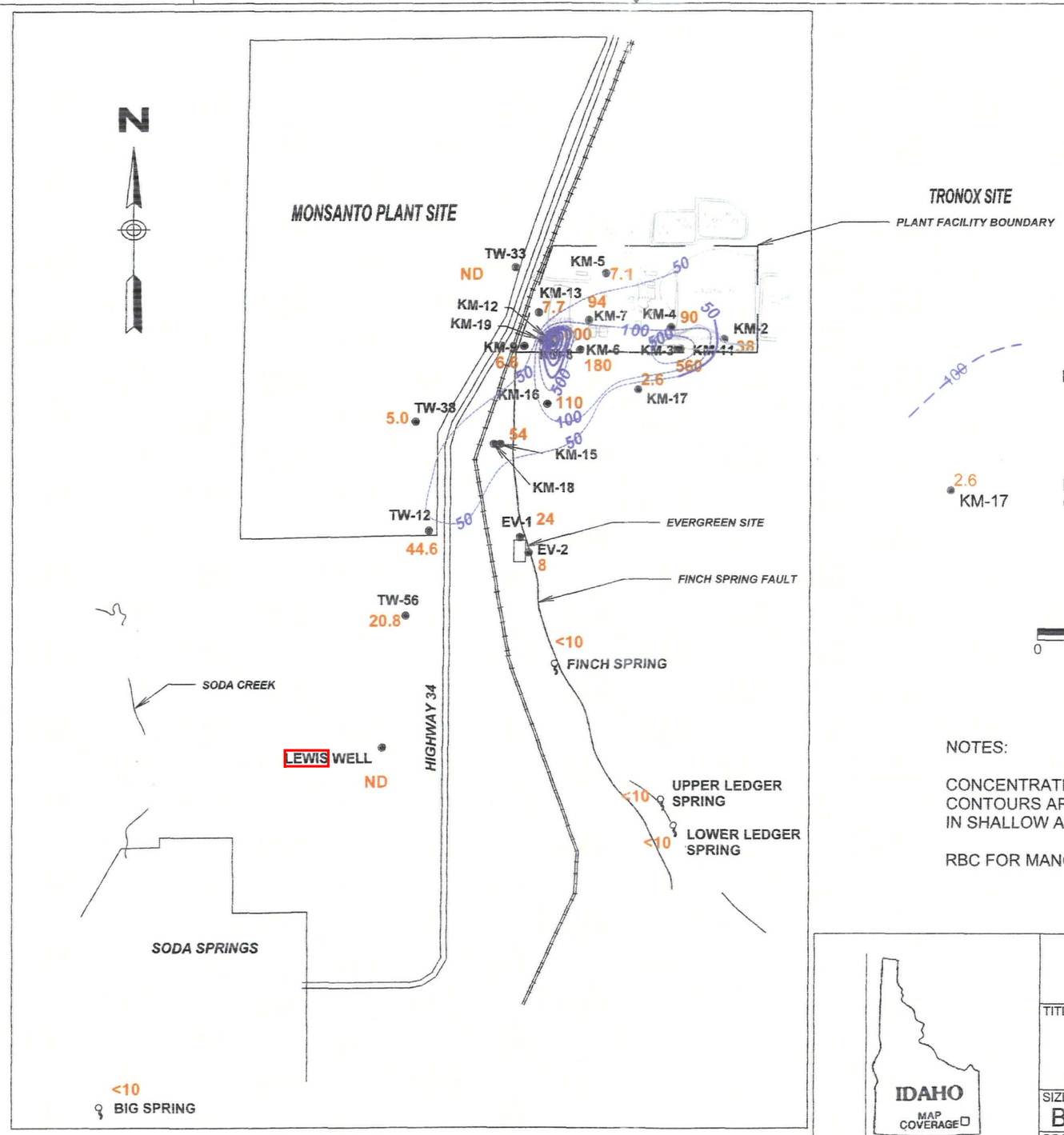

VANADIUM - OFF SITE WELLS AND EVERGREEN WELLS
TOTAL VANADIUM (ug/l)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
DATE
EV-1
EV-2
KM-15
KM-16
KM-17
KM-18

FIGURE 3-18



KEY

INFERRED CONTOUR AND CONCENTRATION

2.6
KM-17

MONITOR WELL LOCATION AND CONCENTRATION IN UG/L

SCALE IN FEET
0 750 1500 3000

NOTES:

CONCENTRATIONS ARE IN UG/L
CONTOURS ARE BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

RBC FOR MANGANESE IS 180 UG/L

IDAHO
MAP COVERAGE

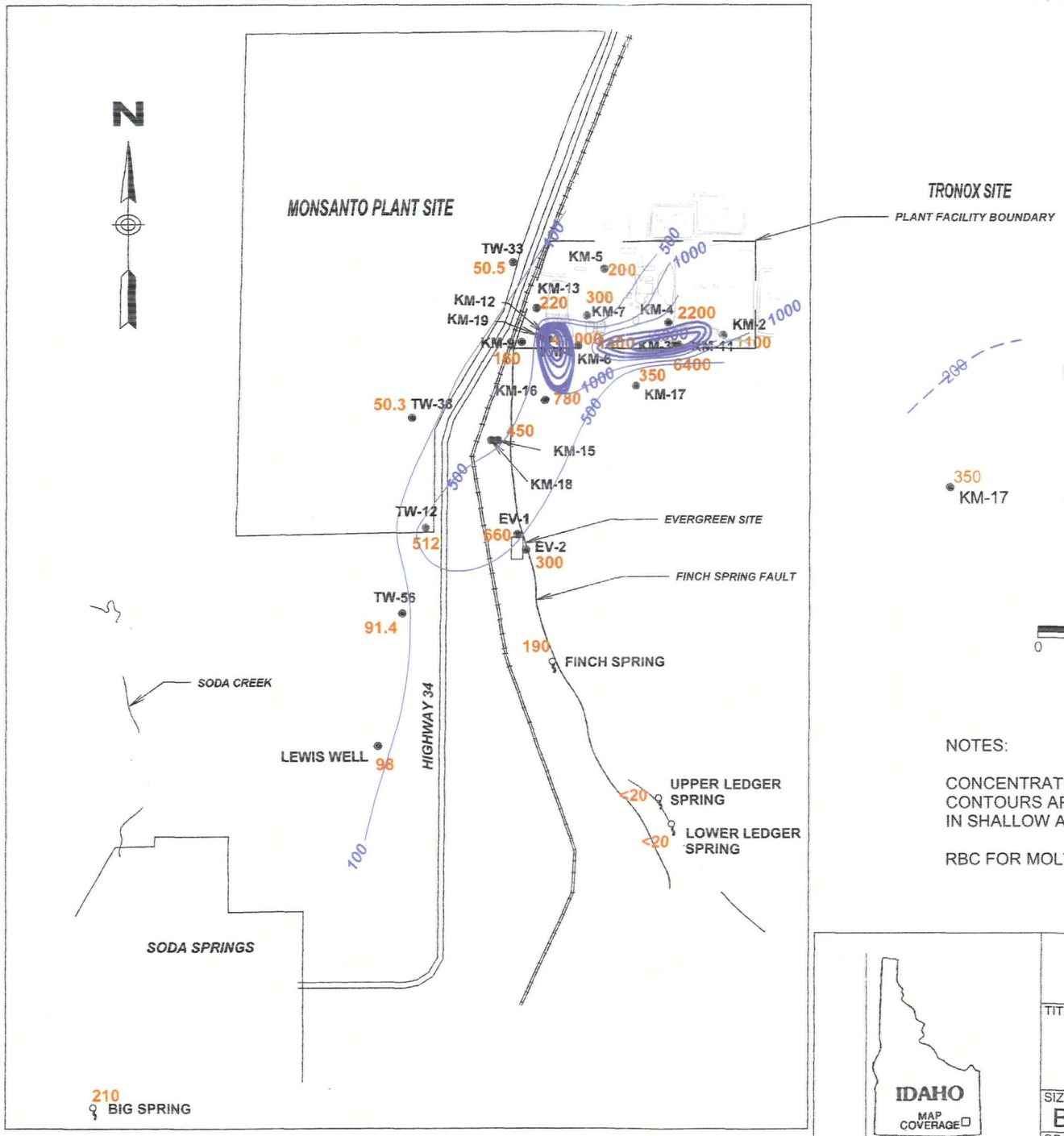
MONITOR WELL NETWORK EVALUATION

TITLE
GROUND AND SURFACE WATER MANGANESE CONCENTRATIONS MAY 2007

SIZE	CAGE CODE	DWG NO	REV
B		WATERSAMPLELOCATIONS.TCW	0

SCALE AS SHOWN

SHEET FIGURE 3-19



KEY

INFERRED CONTOUR AND CONCENTRATION

350
KM-17

MONITOR WELL LOCATION AND CONCENTRATION IN UG/L

SCALE IN FEET
0 750 1500 3000

NOTES:

CONCENTRATIONS ARE IN UG/L
CONTOURS ARE BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

RBC FOR MOLYBDENUM IS 180 UG/L

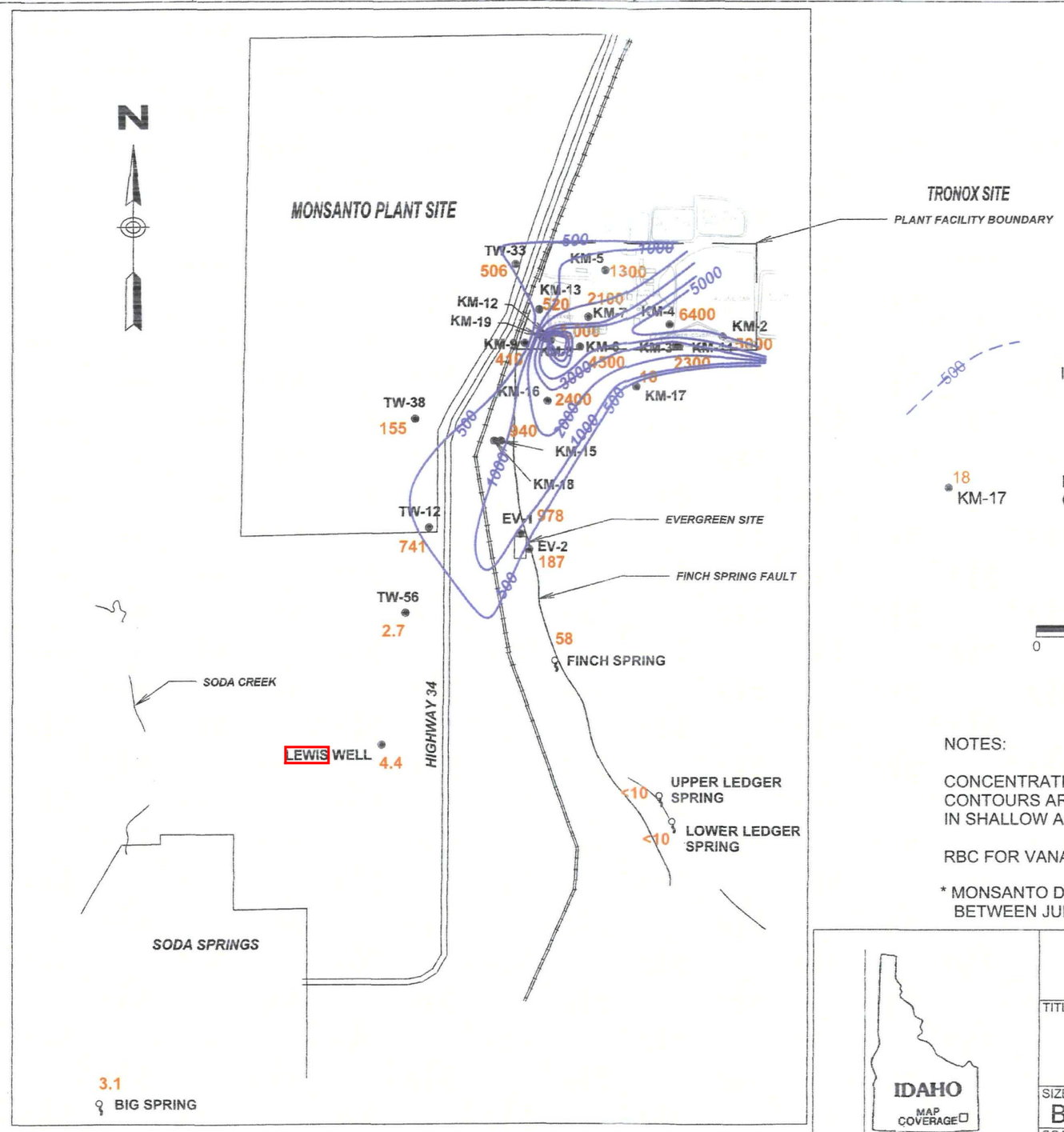
MONITOR WELL NETWORK EVALUATION

TITLE
GROUND AND SURFACE WATER MOLYBDENUM CONCENTRATIONS MAY 2007

SIZE	CAGE CODE	DWG NO	REV
B		WATERSAMPLELOCATIONS.TCW	0

SCALE AS SHOWN

SHEET FIGURE 3-20



KEY

INFERRED CONTOUR AND CONCENTRATION

18
KM-17

MONITOR WELL LOCATION AND CONCENTRATION IN UG/L

SCALE IN FEET
0 750 1500 3000

NOTES:

CONCENTRATIONS ARE IN UG/L
CONTOURS ARE BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

RBC FOR VANADIUM IS 260 UG/L

* MONSANTO DATA OBTAINED BY GOLDER BETWEEN JUNE 19 AND JUNE 27, 2007

MONITOR WELL NETWORK EVALUATION

TITLE
GROUND AND SURFACE WATER VANADIUM CONCENTRATIONS MAY 2007*

SIZE	CAGE CODE	DWG NO	REV
B		WATERSAMPLELOCATIONS.TCW	0

SCALE AS SHOWN

SHEET FIGURE 3-21

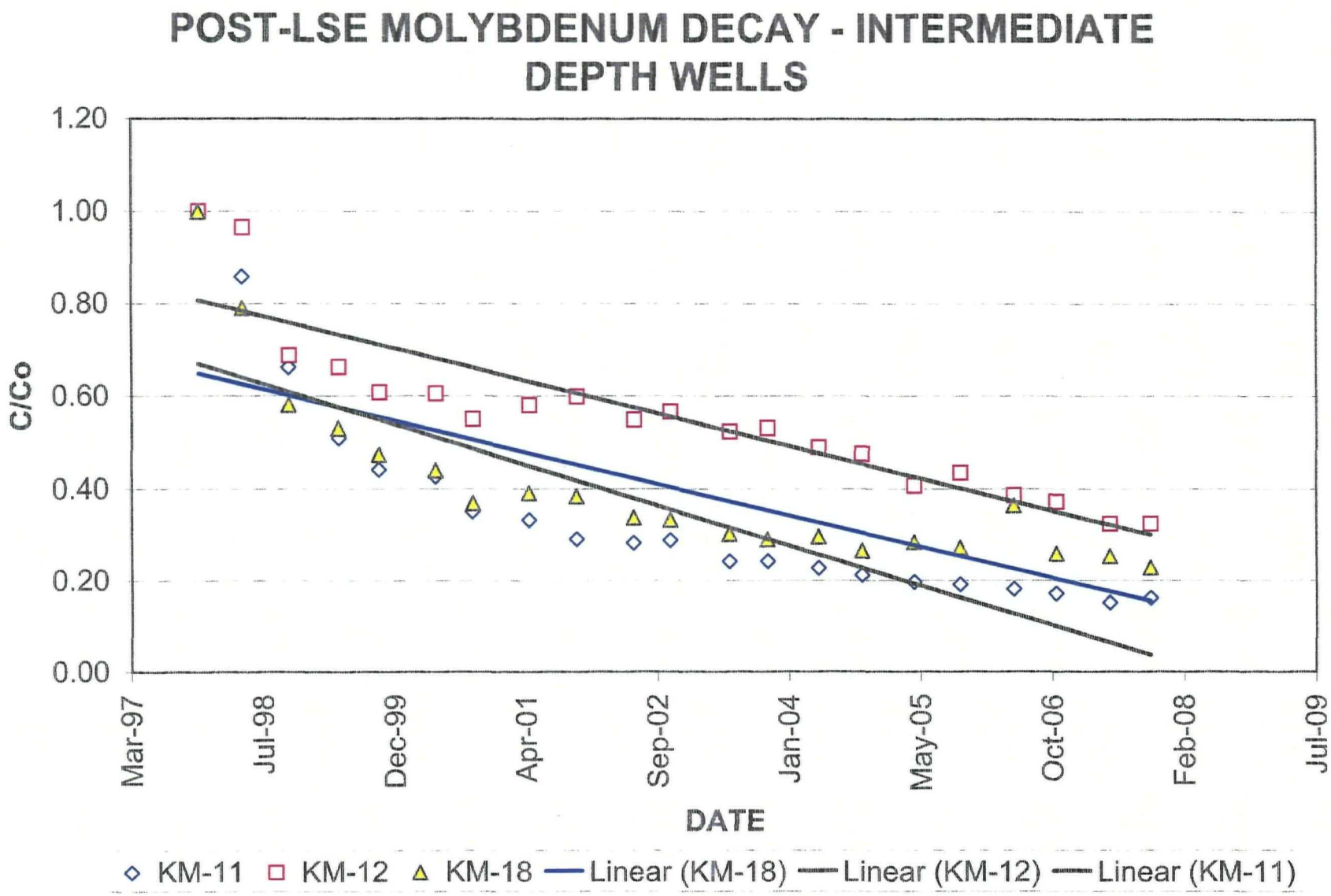

POST-LSE MOLYBDENUM DECAY - INTERMEDIATE DEPTH WELLS
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/Co
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-11
KM-12
KM-18
Linear (KM-18)
Linear (KM-12)
Linear (KM-11)

FIGURE 3-22

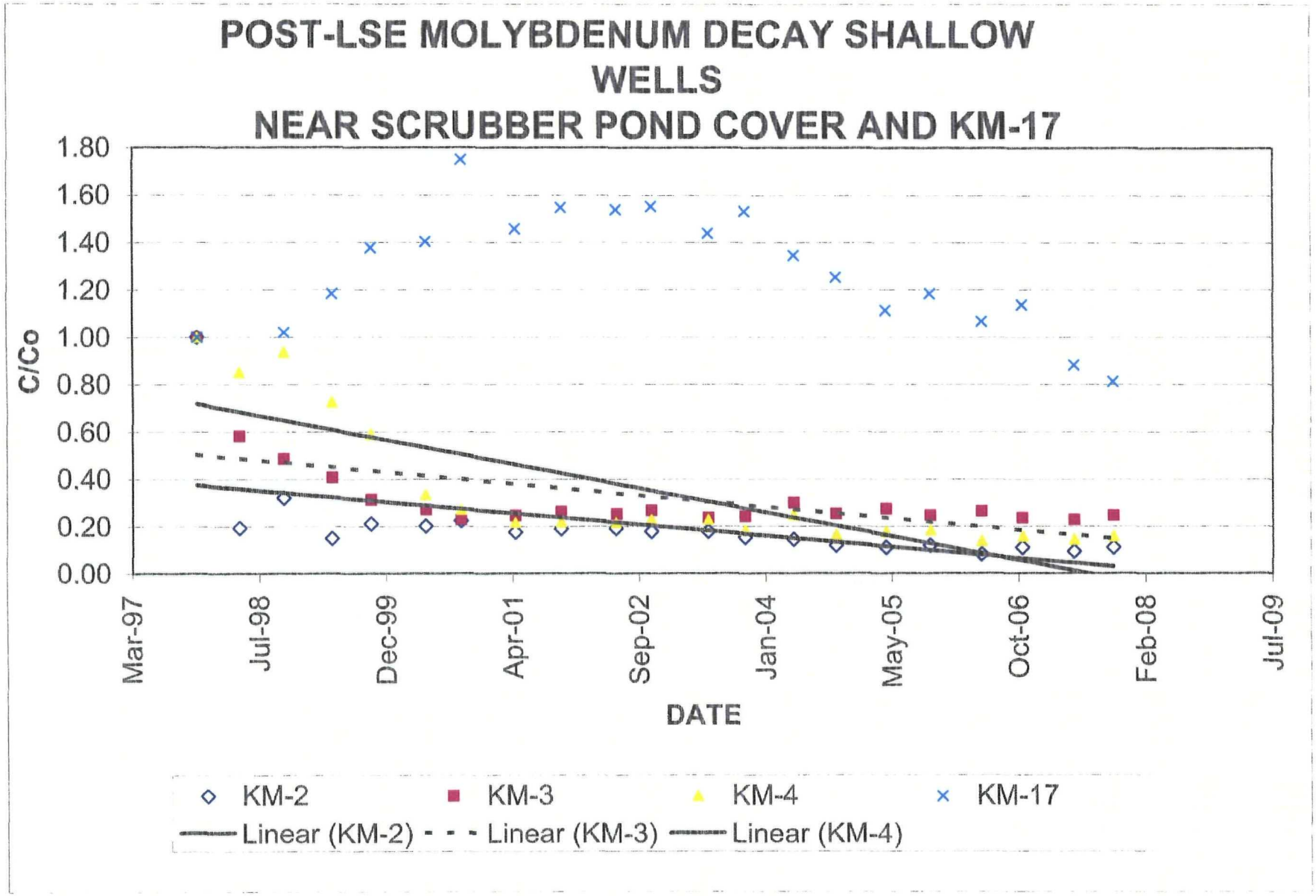

POST-LSE MOLYBDENUM DECAY SHALLOW WELLS
NEAR SCRUBBER POND COVER AND KM-17
C/Co
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-2
KM-3
KM-4
KM-17
Linear (KM-2)
Linear (KM-3)
Linear (KM-4)

FIGURE 3-23

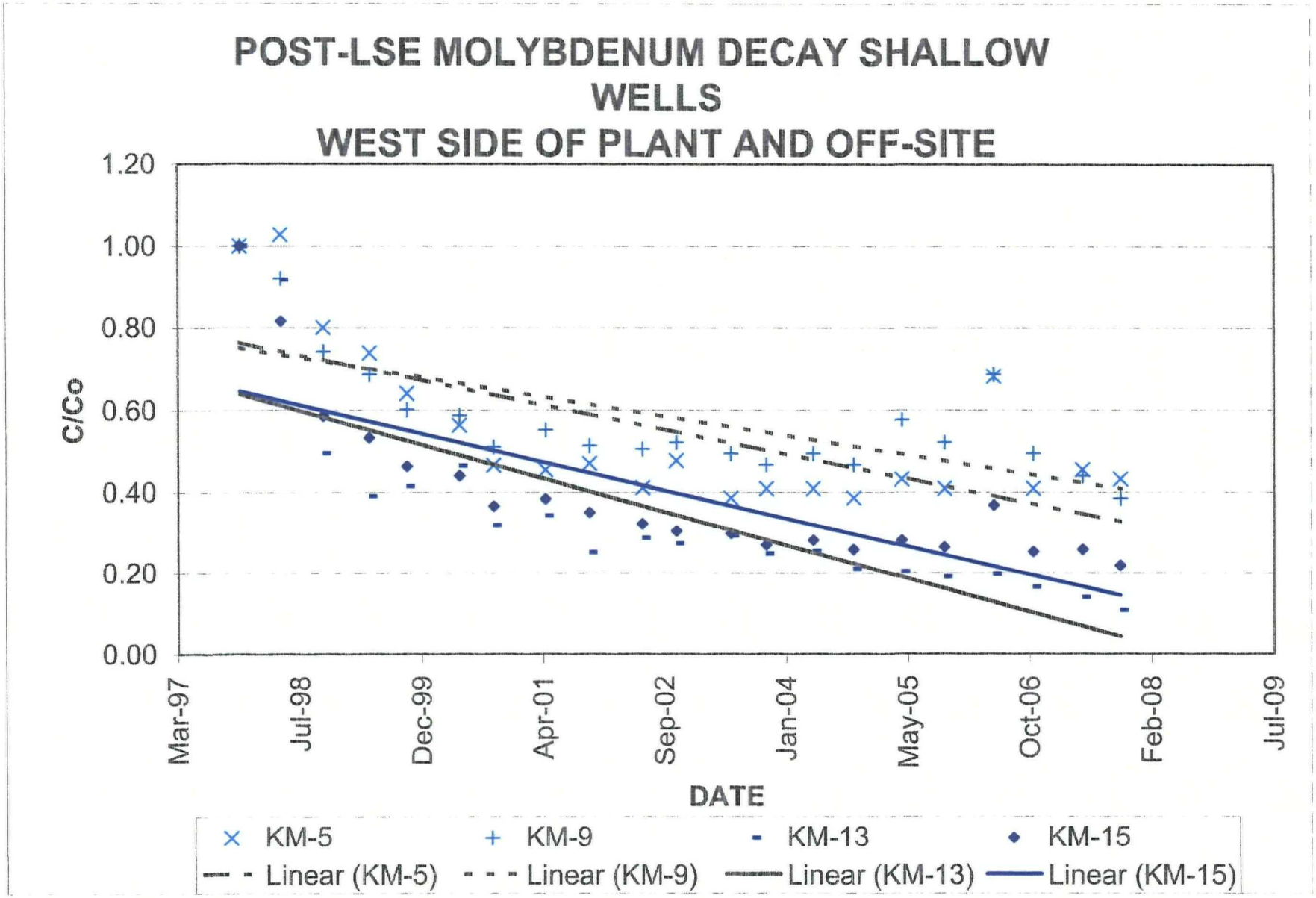

POST-LSE MOLYBDENUM DECAY SHALLOW WELLS
WEST SIDE OF PLANT AND OFF-SITE
C/Co
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-5
KM-9
KM-13
KM-15
Linear (KM-5)
Linear (KM-9)
Linear (KM-13)
Linear (KM-15)

FIGURE 3-24

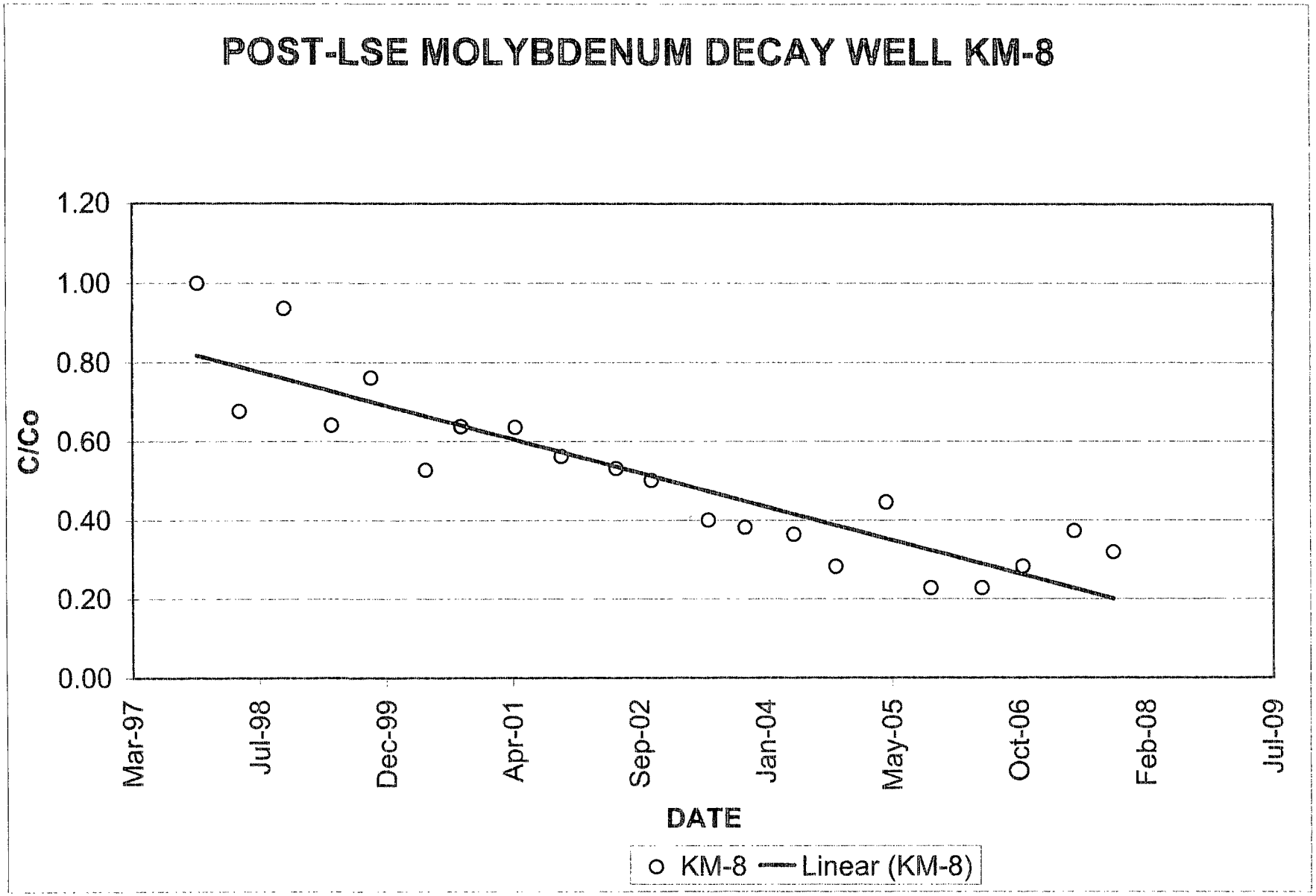

POST-LSE MOLYBDENUM DECAY WELL KM-8
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/Co
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-8
Linear (KM-8)

FIGURE 3-25

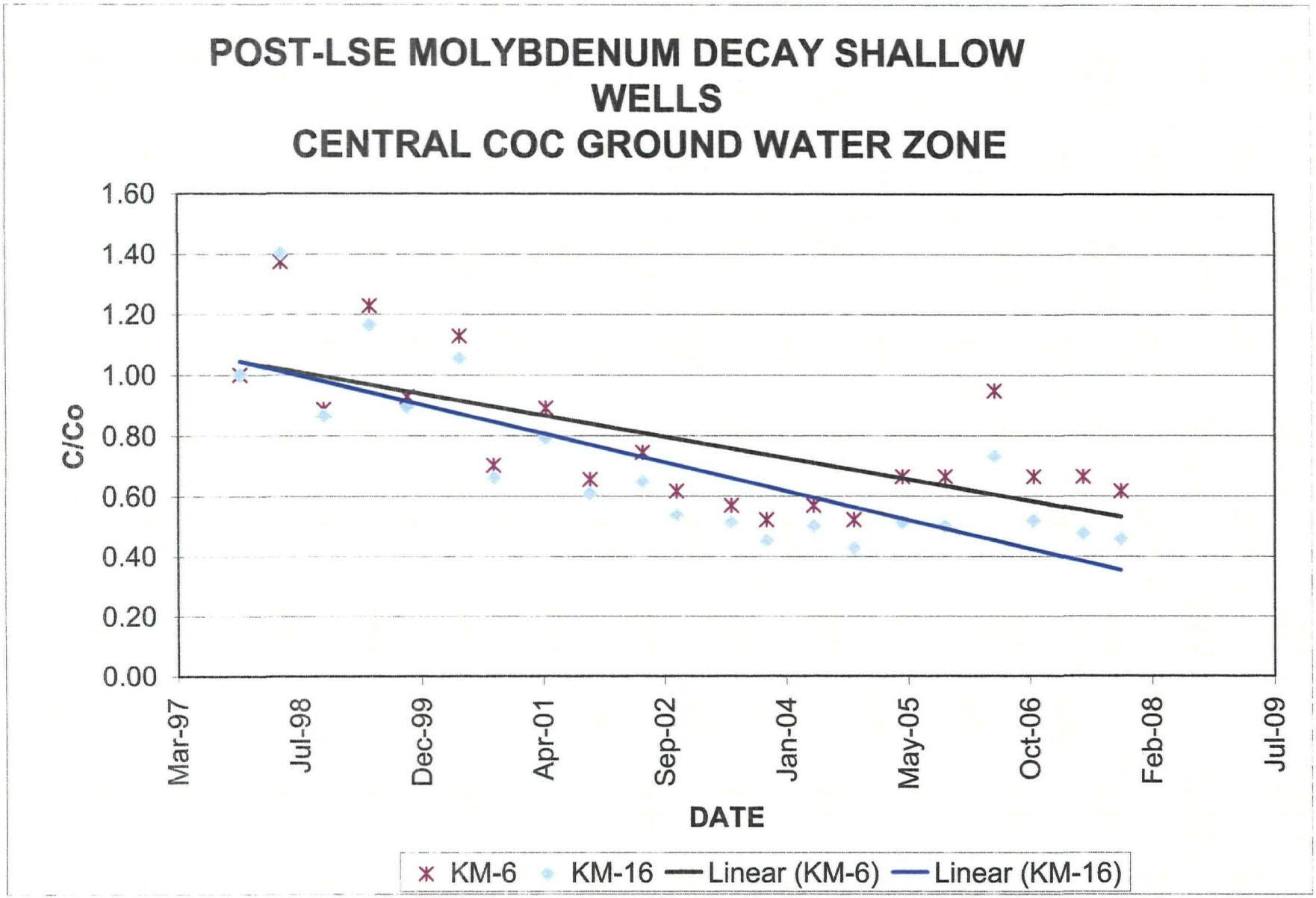

POST-LSE MOLYBDENUM DECAY SHALLOW WELLS
CENTRAL COC GROUND WATER ZONE
C/Co
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-6
KM-16
Linear (KM-6)
Linear (KM-16)

FIGURE 3-26

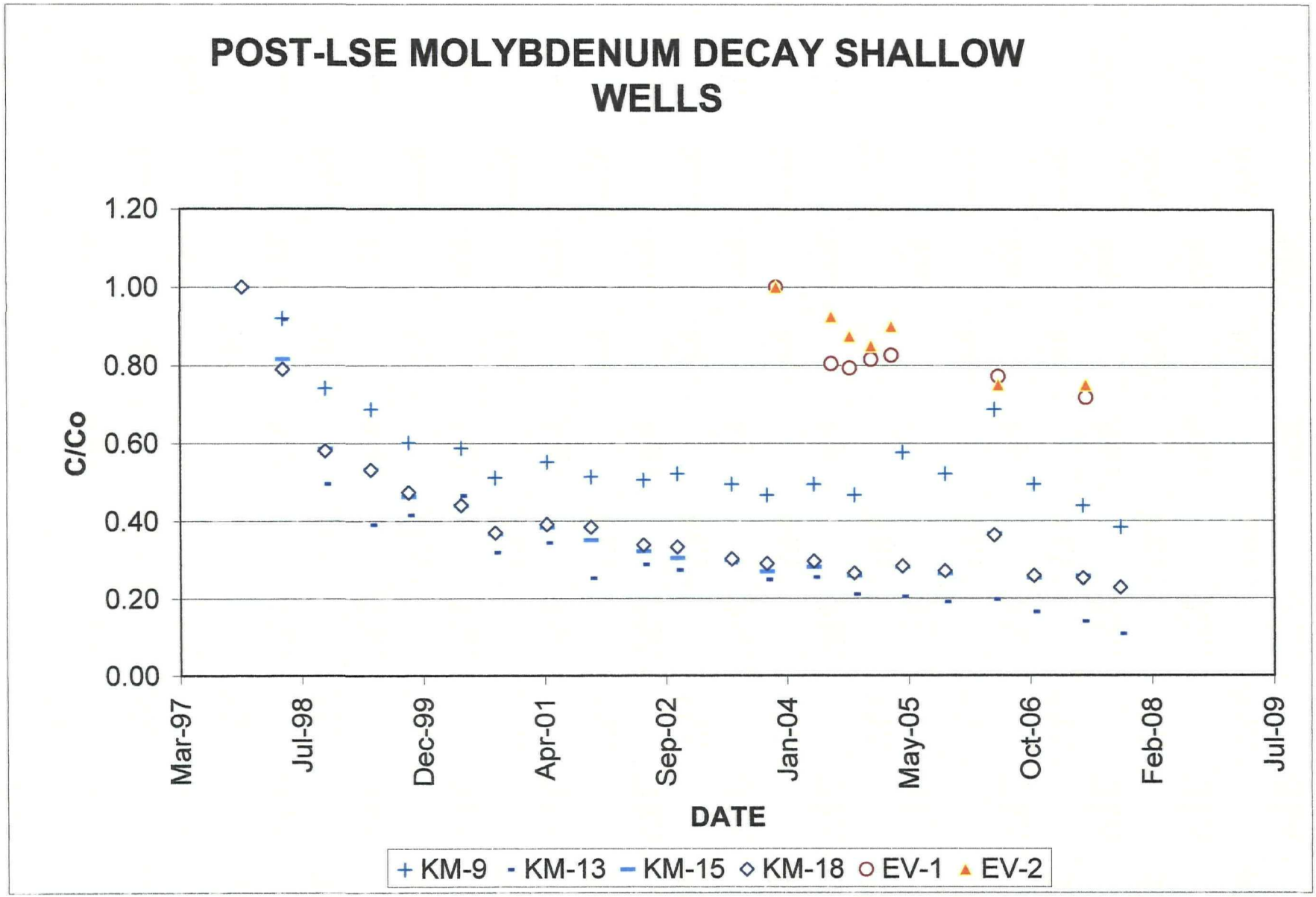

POST-LSE MOLYBDENUM DECAY SHALLOW WELLS
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/Co
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-9
KM-13
KM-15
KM-18
EV-1
EV-2

FIGURE 3-27

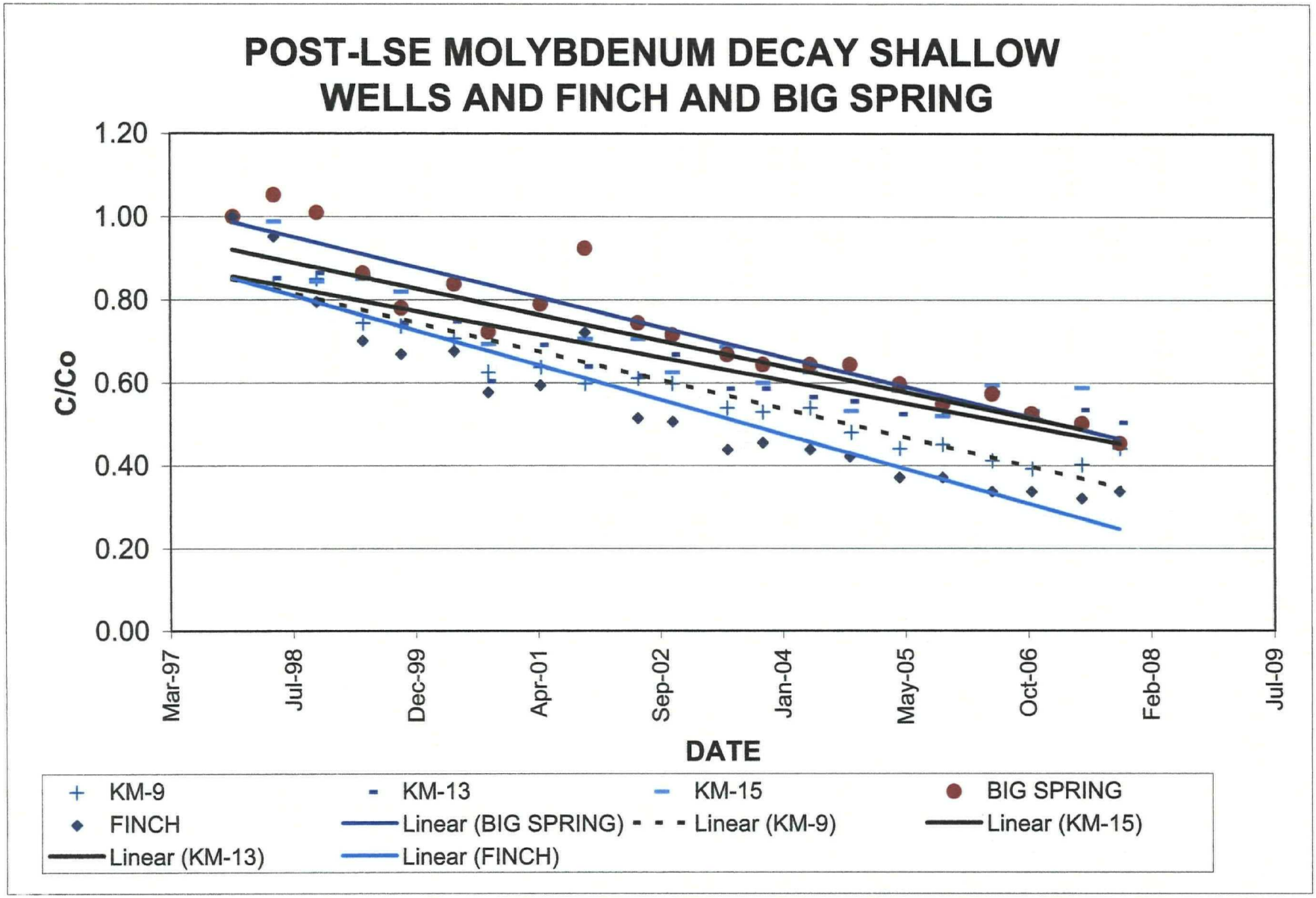

POST-LSE MOLYBDENUM DECAY SHALLOW WELLS AND FINCH AND BIG SPRING
C/Co
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-9
KM-13
KM-15
BIG SPRING
FINCH
Linear (BIG SPRING)
Linear (KM-9)
Linear (KM-15)
Linear (KM-13)
Linear (FINCH)

FIGURE 3-28

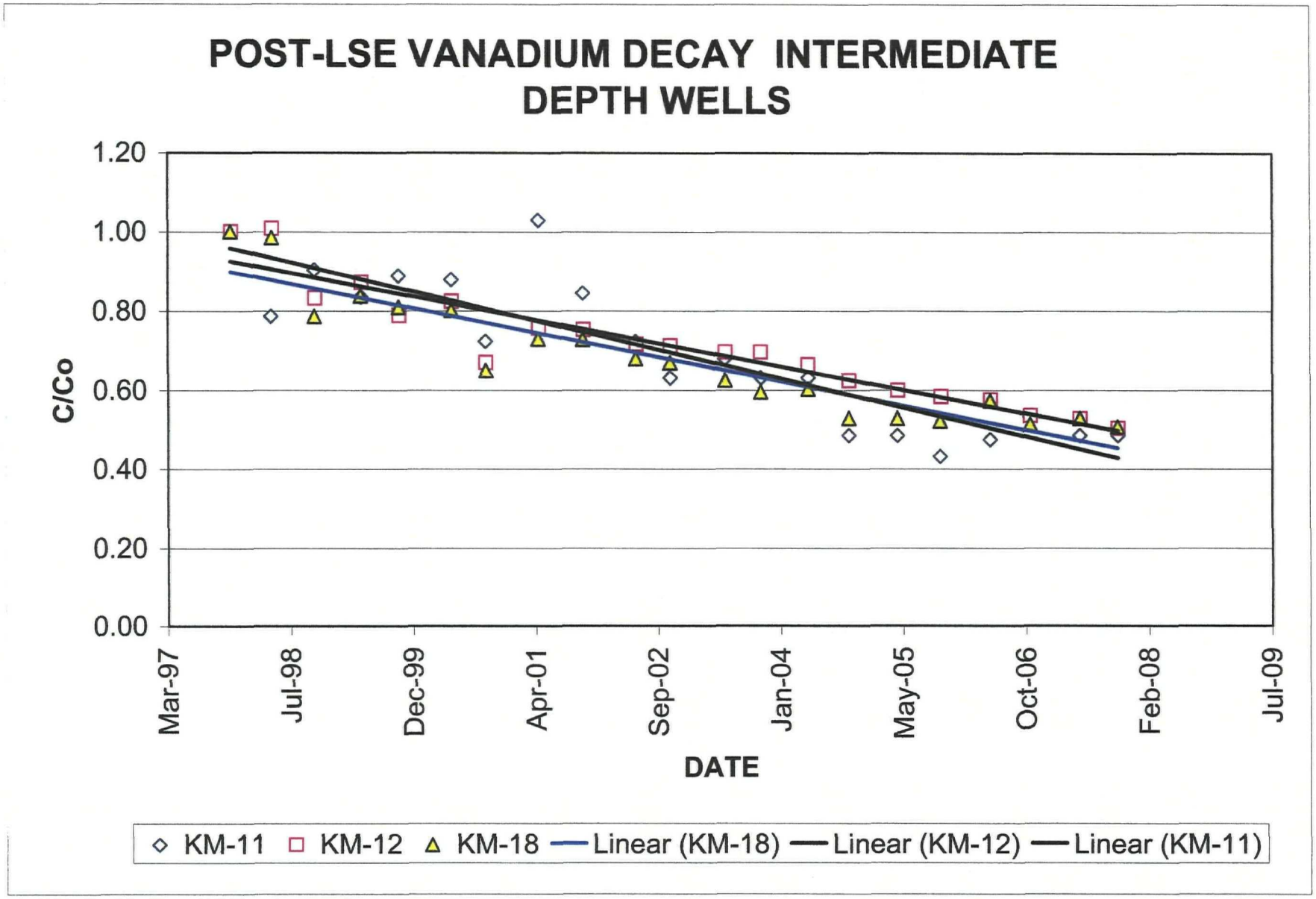

POST-LSE VANADIUM DECAY INTERMEDIATE DEPTH WELLS
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/Co
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-11
KM-12
KM-18
Linear (KM-18)
Linear (KM-12)
Linear (KM-11)

FIGURE 3-29

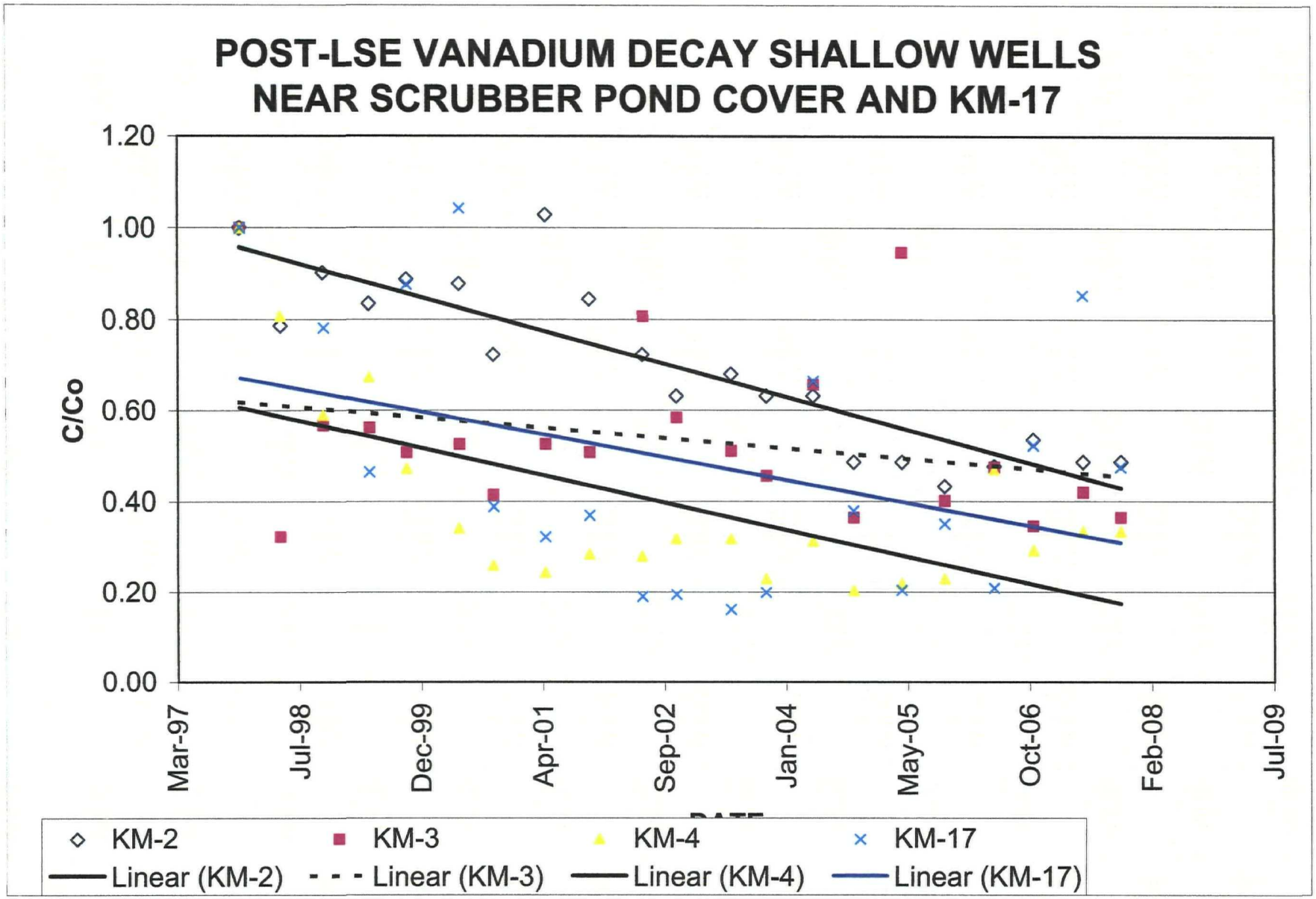

POST-LSE VANADIUM DECAY SHALLOW WELLS
NEAR SCRUBBER POND COVER AND KM-17
C/Co
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
KM-2
KM-3
KM-4
KM-17
Linear (KM-2)
Linear (KM-3)
Linear (KM-4)
Linear (KM-17)

FIGURE 3-30

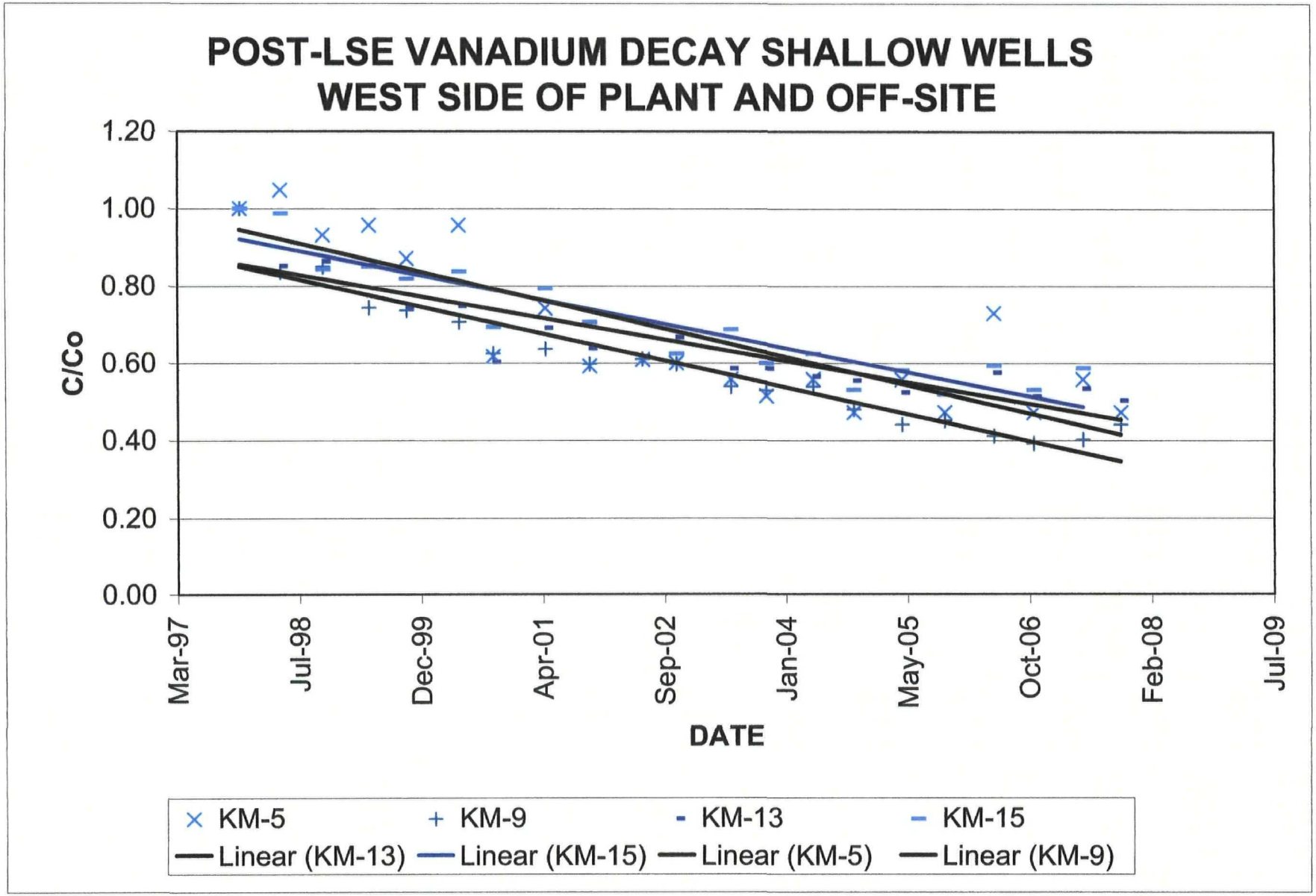

POST-LSE VANADIUM DECAY SHALLOW WELLS
WEST SIDE OF PLANT AND OFF-SITE
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/Co
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-5
KM-9
KM-13
KM-15
Linear (KM-13)
Linear (KM-15)
Linear (KM-5)
Linear (KM-9)

FIGURE 3-31

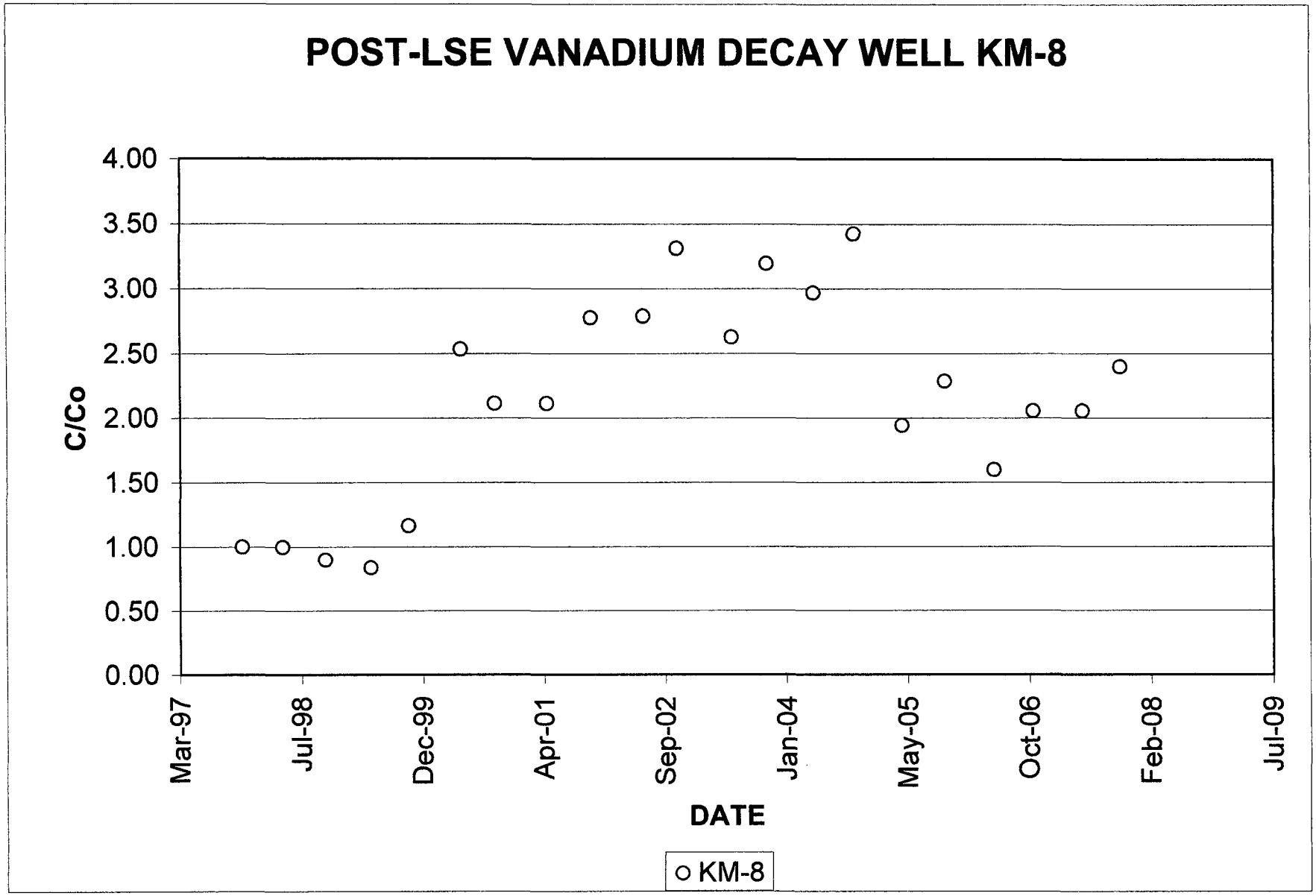

POST-LSE VANADIUM DECAY WELL KM-8
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
C/Co
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-8

FIGURE 3-32

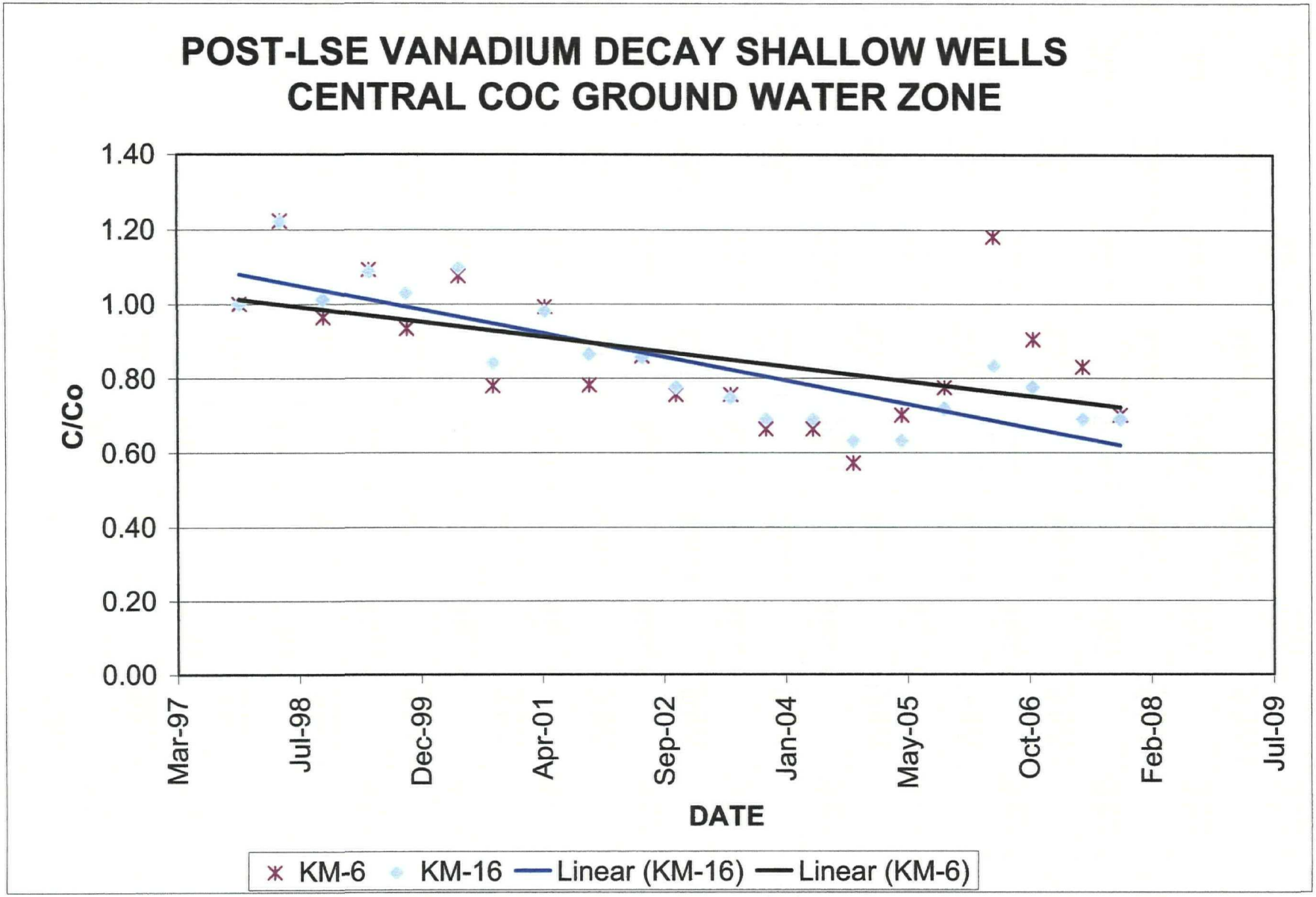

POST-LSE VANADIUM DECAY SHALLOW WELLS
CENTRAL COC GROUND WATER ZONE
C/Co
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-6
KM-16
Linear (KM-16)
Linear (KM-6)

FIGURE 3-33

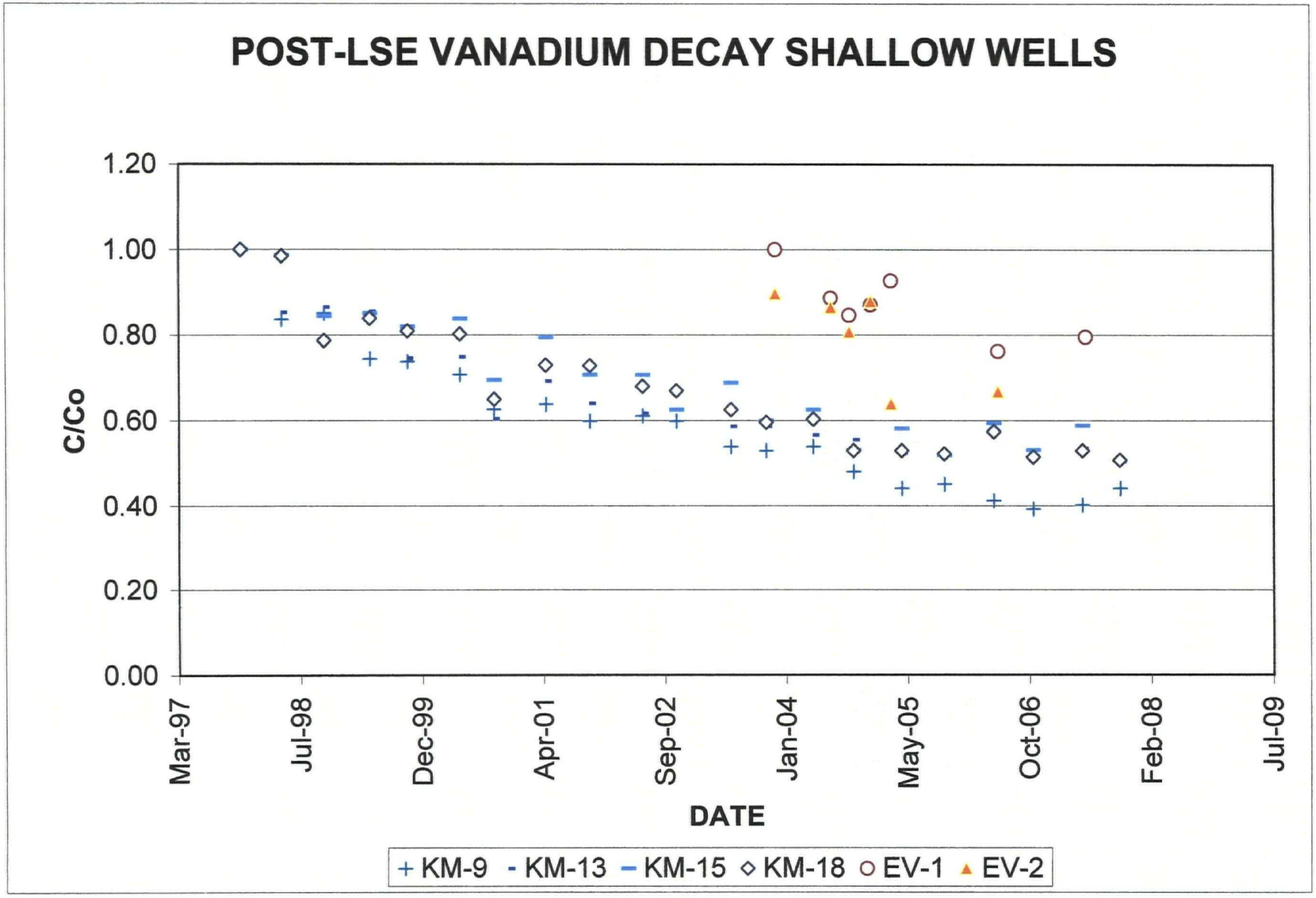

POST-LSE VANADIUM DECAY SHALLOW WELLS
1.20
1.00
0.80
0.60
0.40
0.20
0.00
C/Co
Mar-97
Jul-98
Dec-99
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
DATE
KM-9
KM-13
KM-15
KM-18
EV-1
EV-2

FIGURE 3-34

APPENDIX A

2007 ANNUAL COMPREHENSIVE REPORT OF GROUND AND SURFACE WATER QUALITY TRONOX SODA SPRINGS, IDAHO FACILITY

October 18, 2007

Prepared by:

GLOBAL ENVIRONMENTAL TECHNOLOGIES L.L.C.

GLOBAL ENVIRONMENTAL TECHNOLOGIES L.L.C.

October 18, 2007

TRONOX
P.O. Box 478
Soda Springs, Idaho 83276

Attn: Mr. Boyd Schvaneveldt
Plant Manager

RE: TRANSMITTAL: REMEDIAL ACTION 2007 ANNUAL COMPREHENSIVE REPORT OF GROUND AND SURFACE WATER QUALITY TRONOX SODA SPRINGS, IDAHO FACILITY

Dear Mr. Schvaneveldt:

Enclosed please find transmitted the Remedial Action 2007 Annual Comprehensive Report of Ground and Surface Water Quality for the TRONOX Soda Springs, Idaho Facility. This document consist of: 1) an evaluation of the most currently available (May 2007) ground water quality distribution at on- and off-site locations for selected parameters; 2) an evaluation of ground and surface water quality changes with time; 3) projected decay trends for selected COC and wells, and; 4) conclusions regarding the effects to ground water from remedial actions and reclamation efforts to date.

We appreciate the opportunity to work with you on this project. If you have any questions regarding this transmittal, please contact us.

Very truly yours,
Global Environmental Technologies, LLC

REGISTERED PROFESSIONAL GEOLOGIST
JOHN S. BROWN
10-19-07
NO. 721
STATE OF IDAHO

John S. Brown, P.G.
Principal/Owner

Attachments: Remedial Action 2007 Annual Comprehensive Report of Ground and Surface Water Quality

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John Hatfield (TRONOX)
Paul Gutwald (TRONOX)
Russ Jones (TRONOX)
Toni Ellington – (TRONOX)
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1.0 INTRODUCTION

1.1 Ground Water Monitoring Program

Tronox (formerly Kerr-McGee Chemical LLC) monitors water levels and water quality in both on- and off-site wells and selected springs on a semiannual basis. Data reports are presented to the EPA and IDEQ on a semiannual basis. A validation report that included the Remedial Design/Remedial Action (RD/RA) database was issued to EPA on September 20, 2007 (GET, 2007). Therefore, the database is not included in this report, and the reader should refer to the data contained in the validation report in conjunction with this document. The RD/RA database contains all analytical data supplied by the laboratory following the completion of the Remedial Investigation/Feasibility Study (RI/FS) study, and was prepared at the request of Region 10 EPA on September 23, 1997.

Monitor wells were installed at strategic locations to monitor specific surface water impoundments, aquifer units, downgradient off-site locations, and the TRONOX facility as a whole. Locations of on- and off-site well placements and screen location depths are shown in Table 1-1. These data are also presented in previous technical memoranda and work plans (Dames & Moore, 1991 a, b and 1992).

Location of the TRONOX site and property owned by Tronox is shown on Figure 1-1. Locations of all TRONOX wells installed during the remedial investigation (RI) are shown on Figure 1-2. Figure 1-2 also presents measured water level elevations and ground water gradients in May 2007.

Thirteen of the 18 RI/FS wells are designated "shallow" wells with total depths of 45 to 73 feet. Four wells are designated "intermediate-depth" wells with total depths of 100 to 173 feet. One well (KM-19) is completed on-site to a total depth of 230 feet and designated a "deep" well.

The shallow wells are completed with 10 feet of well screen that is set in the uppermost-defined basalt flow or interflow zone. Shallow wells were completed within the first occurrence of ground water while drilling. On-site shallow wells include wells KM-1, KM-2, KM-3, KM-4, KM-5, KM-6, KM-7, KM-8, KM-9, and KM-13. Off-site shallow wells include KM-15, KM-16, and KM-17.

The intermediate-depth wells are completed with 20 feet of well screen that is set in a deeper basalt flow identified across the site through geophysical interpretation. On-site intermediate depth wells include KM-10, KM-11, and KM-12. The off-site intermediate-depth well is designated KM-18.

1.2 Remedial Action Completion

A complete discussion of the Remedial Action Completion activities is described in the Draft Remedial Action Completion Report Revision I (GET, 1999), and the Draft Remedial Action Completion Report for Calcine Capping, 2000 through 2001 (GET, 2003). Remedial Action for the TRONOX vanadium facility addressed the selected site remedy from the Record of Decision (ROD, September 1995) and subsequent amendment to the ROD (July 2000). The Remedial Action for the vanadium plant included:

- Elimination of uncontrolled liquid discharges from the site;
- Landfilling solids from the scrubber and S-X ponds at an on-site landfill;
- In-place capping of the wind-blown calcine, roaster reject, reject fertilizer, and active calcine tailings during 2000 and 2001;
- Semi-annual ground water monitoring to determine the effectiveness of source control, and;
- Establishment of institutional controls in affected off-site areas to prevent ingestion of ground water for as long as the ground water exceeds the risk-based concentrations (RBC).

1.2.1 Liquid Source Elimination

The ROD required TRONOX (formerly Kerr-McGee Chemical LLC) to implement Liquid Source Elimination (LSE) to eliminate the uncontrolled releases of process water to ground water. During 1993, the unlined magnesium ammonium phosphate (MAP) ponds were removed from service and covered. This action had an immediate effect on water quality in nearby well KM-5. Three larger unlined ponds at the facility were either eliminated or replaced to accomplish LSE between 1995 and 1997. These three ponds included the roaster scrubber pond, S-X raffinate pond, and the calcine pond. Elimination of these ponds also had an effect on ground water quality

1.2.1.1 Scrubber Pond

Wet scrubbers controlled air emissions from the roasters since the plant began operating in 1963. The solids collected in the scrubbers and in the discharge water were pumped to various scrubber water ponds. This management practice resulted in an uncontrolled release of the process water to ground water, and left the solids from the process impounded in each pond. The scrubber sediments from the former pond on the east side of the facility were impounded in the on-site landfill, constructed during 1997.

The wet scrubbers were replaced by a baghouse system on each roaster in 1997. The baghouse collected particulate emissions without the use of water. Solids collected in the baghouse were impounded with the calcine. The result of the installation of the baghouse system was the elimination of the scrubber pond. This allowed for the excavation and placement of the roaster scrubber solids in the landfill and the closure and reclamation of the roaster scrubber pond.

The vanadium plant and supporting baghouse facilities were dismantled between October 2001 and February 2002. The footprint of the vanadium plant was covered

with limestone fines and recontoured to provide positive drainage away from the site of the former facility.

1.2.1.2 S-X Pond

TRONOX constructed double-lined ponds in 1995 and 1997 to contain the raffinate stream. The 5-acre ponds were reclaimed in 2004. Use of the unlined S-X pond was discontinued by 1996 and the sediment was pushed into a pile when the bottom was dry. The S-X pond sediments were impounded in the on-site constructed landfill in 1997.

1.2.1.3 Calcine Pond

Historically, calcine was deposited in the impoundment area by mixing the solids from the vanadium leaching process with water and pumping the slurry to the calcine impoundment. The water used in this operation infiltrated through unlined calcine ponds. TRONOX installed a mechanical dewatering system to separate the water and the calcine in 1997, eliminating the pond. No calcine was produced following closure of the plant in 1999 and the calcine impoundment site was capped with synthetic liner in 2001.

1.3 LSE Completion

TRONOX excavated and transported S-X and scrubber pond sludge to an engineered landfill constructed during September 1997. The S-X pond was taken out of service during 1996. During November 1996, the S-X pond sediments and underlying soils were scraped to the south end of the pond and covered with plastic. This allowed an extended period for the S-X solids to dry and consolidate. The scrubber pond came out of service in April 1997 and was drained prior to sediment thickness investigation.

The scrubber solids were worked into windrows and piles in the scrubber pond basin to accelerate drying. Prior to compaction in the landfill, the wastes were mixed at a ratio of 3:1 scrubber to S-X solids to achieve optimum moisture for compaction. During the last week of September 1997, the Idaho Department of Environmental Quality (IDEQ) inspected the pond basins and determined that all of the pond solids had been removed from the native soils lining the pond basins. Several feet of clean native soil were placed in the pond basins to support growth of a vegetative cover. The overall site slopes were graded and sloped to enhance runoff away from the preexisting pond locations.

Pond reclamation activities occurred during the last week of September and during the first week of October 1997. Following removal of sediment materials from the pond basins and approval of closure from the IDEQ, completeness of sediment removal from pond basins was documented with photographs.

1.4 Ground Water COC

The six contaminants of concern (COC) identified in the Risk Assessment (EPA, 1993) include arsenic, manganese, molybdenum, tributyl phosphate, total petroleum hydrocarbons, and vanadium. Table 1-2 presents a range of concentrations for COC at the POC wells, showing both the largest and the most recent (May 2007) concentrations.

2.0 SUMMARY OF SITE HYDROGEOLOGY

2.1 Site Hydrogeology

Ground water beneath and downgradient from the TRONOX site exists within the basalt sequences, the basalt interflow zones, and within limited areas of the alluvium. Ground water also exists within the Tertiary Salt Lake Formation that underlies the basalt. All of the on-site and off-site monitor wells installed as part of the TRONOX RI/FS are completed at various depths within the basalts, as shown in Table 1-1. Although ground water occurs in the Salt Lake Formation and within a limited area of the alluvium on-site, the basalts are considered the principal aquifer beneath the TRONOX site.

The hydrogeologic properties of the basalts and interflow zones were characterized for the TRONOX RI/FS, using:

- Geologic, geophysical, hydraulic head, hydraulic gradient, and hydraulic conductivity parameters from the installed wells;
- Hydraulic response data observed in the monitor wells, and;
- Observation and testing data from 14 on-site monitor wells, 4 off-site monitor wells and 5 on-site coreholes.

2.1.1 The Salt Lake Formation

The Tertiary Salt Lake Formation is comprised of tuffaceous sandstones, conglomerates and limestones that yield small amounts of ground water for domestic and stock purposes, and are unpredictable as a water-supply source. The Salt Lake Formation is not considered part of the shallow ground water system. The Salt Lake Formation was cored on-site in corehole CH-3 from 231 to 250 feet (total depth of corehole CH-3) and was found to consist of fractured quartzite, sandstone, and clay with a packer test hydraulic conductivity of 0.77 ft/day. This is within, but at the low end of the range of

packer-test hydraulic conductivities estimated for the deeper part of the overlying basalt sequence. No wells at the TRONOX site were completed within this formation.

2.1.2 Alluvium

Seismic refraction studies performed as part of the RI indicated that alluvium is thickest and extends to the greatest depth on the eastern side of the plant facility. Based on geologic data from well KM-2, a small area of thin saturated alluvium overlies the basalt in the eastern part of the TRONOX facility where the elevation of the basalt/alluvium contact falls below the elevation of the water table. Well KM-2 is screened across the basalt/alluvium contact. The area of saturated alluvium appears to be limited near the east side of the facility, extending a short distance to the north and south of the capped calcine tailings. The alluvium has not been noted to contain ground water at other locations on the TRONOX site.

2.1.3 Basalt Aquifer

The basalts and interflow zones of the mid-Pleistocene Blackfoot Lava Field comprise the principal aquifer beneath the TRONOX site. All of the on-site TRONOX monitor wells, with the exception of well KM-2, are screened exclusively within these basalts and interflow zones. The basalt sequence at the TRONOX site, described in the RI is comprised of five identifiable basalt flows (Basalts Nos. Qb_1 through Qb_5) and associated interflow zones (Interflow Zones Nos. I_1 through I_4). Two younger basalts (Qb_{5a} and Qb_{5b}) and associated interflows were identified to the south and west of the site and are believed to have occurred as post-faulting flows. These basalts and interflow zones are believed to be stratigraphically similar to basalt flows identified at the Monsanto Site by Golder (1985 and 1992a). However, the hydrogeologic characteristics of the basalt flows between the two sites appear to be different. Notable differences include:

- Magnitudes of hydraulic conductivities of the basalt flows and interflow zones at the TRONOX site are relatively similar based on the results of extensive aquifer testing,

whereas basalts and interflow units at the Monsanto site are indicated to differ substantially;

- Local water level elevation and water quality differences exist between adjacent shallow, intermediate-depth and deep wells at Monsanto. Water quality and aquifer test data for TRONOX indicate that the entire thickness of saturated basalt is in relatively good vertical hydraulic connection over the area of the TRONOX site, and;

- Faults are considered to represent zones of increased transmissivity at the TRONOX site, whereas they are interpreted to be barriers to flow at the Monsanto site.

2.1.3.1 Hydraulic Conductivities of the Basalt Aquifer

Primary permeability of unbroken basalt is small. Most ground water in basalt is transmitted along secondary features such as joints or fractures. Vertical columnar joints are a common feature observed in basalt exposed to the south and southwest of the site along the trace of the Finch Spring Fault. The presence of intensely fractured or vesicular zones, rubble zones, and/or cinder zones can also greatly increase the ability of basalt to transmit water. Interflow zones are comprised of subaerial deposited materials, including clays, cinderaceous deposits, alluvial sands and gravels, organic debris and weathered and broken basalt. Variations in the ability of interflow zones to transmit water result from changes in the character and thickness of these materials.

Observed hydraulic conductivities estimated from the slug, specific capacity, and pumping tests conducted in the shallow, intermediate-depth, and deep wells include the following:

- Basalts ranged from 8 to 340 ft/day;

- Interflow zones ranged from 90 to more than 200 ft/day.

- Basalts and interflow zones together ranged from 2 to more than 100 ft/day.

- Basalt No. Qb_5 (shallow basalt represented by shallow well screened zones) ranged from about 9 to 340 ft/day.

- Basalt No. Qb_3 (Deeper basalt screened in wells KM-10, KM-11, KM-12, and KM-18) ranged from 8 to almost 100 ft/day.

Hydraulic conductivities estimated for well KM-19 screened in Basalt No. Qb_2 and Interflow Zone No. I_1 ranged from about 15 to almost 70 ft/day.

Generalizations about hydraulic conductivities observed within the basalt aquifer at the TRONOX site include the following:

- The hydraulic conductivities of interflow zones are not significantly greater than those of the basalt flows;
- Hydraulic conductivities of the shallower basalts (Basalt No. Qb_5) are generally greater but not significantly greater than those of the deeper basalts (Basalt No. Qb_3);
- A horizontal layer of significantly smaller hydraulic conductivity which could greatly limit or prevent vertical movement of ground water was not identified;
- A continuous horizontal layer of significantly larger hydraulic conductivity along which horizontal ground water flow could be localized was not identified;
- Hydraulic conductivities in the shallow wells on the east side of the plant (KM-1, KM-2, KM-3, and KM-4) range from 90 to 270 ft/day and appear to be greater than hydraulic conductivities in shallow wells on the west side of the plant (KM-5, KM-8, KM-9, and KM-13), which range from 9 to 48 ft/day.

2.1.3.2 Estimated Ground Water Velocities

Horizontal hydraulic gradients within the shallower basalt aquifer vary from 0.01 feet per foot in the eastern part of the site to 0.03 feet per foot in the western part of the site. Effective porosities have been reported for the basalts of the Snake River Plain aquifer of southeastern Idaho to range from about 8 to 10 percent (Robertson, 1974; Lewis and Goldstein, 1982; Isherwood, 1981; Nace et al., 1959). If an effective porosity of 8 percent and range of hydraulic conductivities of 5 to 270 ft/day is used, then a range of estimated ground water particle velocities of 0.6 to 34 ft/day can be calculated for the eastern part of the plant site. The effective porosity of 8 percent and the observed range of hydraulic conductivities of 9 to 340 ft/day on the western of the site yield a range of estimated ground water particle velocities of 3 to 130 ft/day for the western part of the plant site.

2.2 Current Direction and Rate of Ground Water Flow

Ground water flows in response to hydraulic gradients from areas of higher hydraulic head to areas of lower hydraulic head at rates that are proportional to hydraulic conductivity and hydraulic gradient and inversely proportional to effective porosity of the aquifer. Ground water can flow vertically through aquifers or between aquifers in response to vertical hydraulic gradients and horizontally within aquifers in response to horizontal gradients. Ground water in the Shallow Aquifer System generally flows southward from the topographically higher Blackfoot Reservoir (about 12 miles north of the TRONOX facility) to seeps and springs along the topographically lower Bear River.

Horizontal hydraulic gradients and ground water flow directions within the shallow basalt units at the site are indicated by water level elevations measured during May 2007 and are contoured on Figure 1-2. Site gradient averaged about 0.02 ft/ft in 2007.

The predominant flow direction beneath the plant site is to the west-southwesterly, as shown on Figure 1-2. The western ground water flow direction beneath the site is caused by pumping from the Monsanto production wells located west of the TRONOX site. Ground water levels beneath the east side of the facility suggest a more southerly flow component, with flow beneath the east side of the facility directed towards well KM-3. This subtle change in flow direction may be the result of capping the calcine in 2001. Previous annual evaluations indicated a flatter and more westerly overall flow pattern for this area.

Water level elevations measured during May 2007 in the deeper monitor wells KM-11, KM-12, and KM-18 are also shown on Figure 1-2 but are not contoured. Ground water levels in the deeper wells indicate a pattern of ground water flow that is similar to the pattern observed in the shallow wells.

2.3 Site Water Levels and Site Precipitation

Figure 1-3 presents annual rainfall totals for Soda Springs, Idaho between 1990 and 2006, obtained from Tigert Airport in Soda Springs. Annual totals peaked at about 17.5 inches in 1994 and 1997. Annual precipitation rates declined after 1997 to about 11.5 inches in 2001. Annual precipitation rates have been increasing on average since 2001, to just over 15 inches annual average in 2005 and 2006.

Site ground water level changes over time correlate with variation in the annual average precipitation, rates, although general rises in site water levels lag the precipitation by about three years, based on the observation of the low annual average in 2001 and recovery in water levels in site wells after 2004. Overall, water levels dropped on average 5 to 8 feet between 1997 and October 2001, and then remained at lowered levels in the fall through 2004, as indicated on Figure 1-4. Water levels recovered several feet between 2004 and 2007, towards the range of levels observed in 1997. This recovery may have affected concentrations in a number of wells. Seasonal water levels are typically higher by about 2 to 3 feet in the spring when compared with the fall water levels.

3.0 GROUND WATER SAMPLING

3.1 Ground Water Point of Compliance

The Record of Decision (EPA, September 1995) stated that the point of compliance (POC) for the evaluation of the selected remedial actions for ground water will be the boundary of the current active industrial facility, using the existing monitoring wells (EPA, 1995). During the RI, TRONOX placed monitor wells at strategic locations to monitor specific impoundments, aquifer units, downgradient off-site locations, and the facility as a whole. Locations of on- and off-site well placements and screen location depths were presented in previous technical memoranda and work plans.

During 2004, TRONOX purchased the Hopkins property to the south of the former industrial facility. This property includes the areas containing the monitoring wells KM-15, KM-16, KM-17, and KM-18, that have been designated the "off-site" wells in all previous documents. The off-site designation is continued in this document, referring to wells that are located off of the industrial facility, as established by EPA.

POC wells include wells KM-2, KM-3, KM-5, KM-8, KM-9, KM-11, KM-12, KM-13, and KM-19. EPA requested the addition of wells KM-2, KM-3 and KM-11 to the list in their May 6, 1997 correspondence and TRONOX included POC sampling for these wells. Table 3-1 provides the justifications used for sampling of POC wells at the site, and for sampling off-site well and spring locations.

3.2 Ground Water Sampling and Analysis Plan

A ground and surface water sampling plan was developed for the RD/RA sampling events for on-going semiannual sampling. This plan was finalized and accepted by EPA during May 1997. An additional low-flow sampling plan was developed during September 1997 to incorporate low-flow sampling methods described below.

3.2.1 Low-Flow Purge Sampling Methods

TRONOX installed stainless steel submersible pumps in each of the sampling wells during October 1997. A pump was installed in KM-7 during May 2000. These pumps are dedicated for evacuation and sampling purposes. Each pump is operated by a portable generator system. Each pump is suspended on Schedule 80 1-inch PVC piping and a stainless steel safety cable (in intermediate depth and deep wells), such that the intake level on each pump is placed in the approximate center of the well screened interval.

Low-flow well purging was first performed during the November 1997 sampling round following dedicated pump installation in each of the sampled wells. Low-flow sampling methods are based on EPA Region 1 "Low Flow SOP" dated May 13, 1996 and the EPA document "Low-Flow (Minimal Drawdown) Ground Water Sampling Procedures" dated April 1996. This method was provided as an addendum to the RD/RA Sampling and Analysis Plan (SAP) deliverable submitted to EPA during May 1997 and approved by Region 10 EPA on June 6, 1997. Low-flow sampling is performed on all of the "KM" series wells with the exception of non-POC wells KM-1 and KM-10. Wells KM-1 and KM-10 are monitored for water level purposes only.

During sampling, flow rates are measured concurrent with drawdown in each well to assess stabilization of purged ground water. A discharge assembly is used to control the rate of discharge from each well via use of a ball valve. The assembly is used to control discharge from each well during sampling such that the amount of discharge will not allow the well to be drawn down more than 0.3 feet during purging and sampling events.

Field measurements are made through the use of a turbidity meter and flow cell. The flow cell is used to measure pH, temperature, specific conductance, and dissolved oxygen. Field data are graphed following sample collection to show stabilization of field parameter measurements with time prior to sample collection. These graphs are

presented with the semiannual data validation reports. Criteria used to determine whether the purged water has stabilized include:

- pH within ± 0.3 units;
- Temperature to within ± 2 degrees;
- Specific Conductance within ± 10 percent;
- Dissolved oxygen within ± 10 percent, and;
- Turbidity within ± 10 percent.

If the parameters do not stabilize to meet the above criteria within the extraction of three casing volumes, then a sample is obtained following the removal of not more than three casing volumes. Samples are collected from the discharge point beyond the ball valve. Samples are collected and handled in accordance with the May 1997 SAP.

3.3 QA/QC Data Review

QA/QC review is performed on a semiannual basis after receipt of the data from the lab. Results of the QA/QC data review are presented in the semiannual data validation report, and are not included in this annual ground water review.

4.0 RECENT GROUND AND SURFACE WATER QUALITY

Recent ground and surface water quality refers to the results of samples obtained between the dates of May 14 through May 16, 2007 the (May 2007 sampling round).

4.1 Background Water Quality and Type

Upgradient off-site springs and wells were sampled during the RI, but are no longer sampled. The reader is encouraged to refer to the RI report (Dames & Moore, 1995). Locations sampled from background for the TRONOX site included Formation Spring, and several other private wells to the north and east of the site. These background locations have not been sampled since 1991 since clean-up performance is based on the POC wells.

TDS concentrations are about 500 mg/l in background wells and springs. The largest reported TDS concentration from background locations was 579 mg/l in Formation Spring. The pH values measured at the background locations are near neutral and ranged from 6.8 to 7.4 units. Specific conductance ranged from about 840 umhos/cm in the private wells to about 970 umhos/cm in Formation Spring.

Reported background chloride concentrations are about 3.9 mg/l. Background sulfate concentrations are in the range of about 40 mg/l. Nitrate concentrations range from 0.11 mg/l in Formation Spring to 0.75 mg/l in private wells. Concentrations of aluminum, arsenic, chromium, manganese, molybdenum, nickel, selenium, and vanadium are less than detection at upgradient private wells and springs located to the east of the site.

Background ground water quality and type was characterized during the RI using the trilinear diagram classification method developed by Piper (1944). The Piper diagram consists of two ternary fields (triangles) for plotting percentages of cations (left triangle) and anions (right triangle), and a central diamond-shaped composite field for plotting the relative contribution of the major ion pairs. Based on the Piper plots, the site background

water type plots in a specific pattern and can be classified as calcium-magnesium bicarbonate-type water.

4.2 Common Ion Distributions in Ground Water

The Piper plots evaluated during the RI indicated a mixing of background-type waters beneath the site with pond seepage and contributions from leachate produced in the vadose zone. Water flowing onto the site is relatively high in calcium and low in sodium and potassium. Waters are also compositionally high in bicarbonate. Waters mixed beneath the site increase substantially in sodium, potassium, sulfate and chloride (Dames & Moore, 1995).

4.3 General Ground Water Quality Parameters

4.3.1 pH

The pH range in wells across the site historically indicated neutral to slightly alkaline conditions in the past. Between 1999 and 2001, field pH was found to be lower in many of the wells near the reclaimed S-X pond including samples from wells KM-6, KM-7, KM-8, KM-12, KM-19, and near the reclaimed scrubber pond (KM-2, KM-3, KM-4, and KM-11). The lower ground water pH (range of 6.1 to 6.9) likely had some affect on concentration trends for metals during the 1999 through 2001 period, causing small metals concentration increases during this period. Current site distribution of pH is shown on Figure 4-1. During the May 2007 sampling event, pH indicated decreasing units of concentration from east to west across the site, with the lowest pH in the vicinity of well KM-8.

4.3.2 Total Dissolved Solids

Ground water TDS concentrations in on-site wells ranged from slightly less than 500 mg/l in wells KM-1 and KM-10 (previous results) to about 11,000 mg/l (current) in well KM-8. The secondary drinking water standard for TDS (500 mg/l) was exceeded in

most of the TRONOX POC wells. Recent concentrations of TDS are shown in Figure 4-2. TDS is elevated in shallow wells surrounding the reclaimed scrubber pond, located to the south of the calcine tailing area that was capped in 2001. Concentrations of TDS in intermediate-depth well KM-11 is within the range of background. Beneath the west side of the site, TDS concentration in well KM-8 is substantially larger than nearby wells KM-9 and KM-13 which are within the range of background TDS concentrations. TDS is elevated above background in wells KM-6 and intermediate depth well KM-12 near the S-X pond. TDS concentration in deep well KM-19 (510 mg/l) is also within the range of background.

At off-site ground water locations, TDS concentrations are elevated in wells KM-15 through KM-18, ranging from 590 to 700 mg/l. Finch Spring, located approximately 4400 feet south of the TRONOX site, indicates a TDS concentration of 530 mg/l, while Big Spring is was slightly greater at 640 mg/l.

4.3.3 Turbidity

Turbidity was measured in the field during low-flow purging of the wells. Results of turbidity for the 2007 sampling events are summarized in Table 1 and presented graphically in Appendix A of the May 2007 Laboratory Data Quality Report (GET, September 19, 2007). Although turbidity is generally not considered an indicator of ground water contamination, excessive turbidity in an unfiltered sample can bias analytical results causing reported total metals concentrations to be unrepresentative of true concentrations in ground water. Turbidity is a measure of the solids and suspended organic material in a sample and is reported in nephelometric turbidity units (NTUs).

May 2007 turbidity ranged from 0.45 NTUs in well KM-17 to 12.2 NTUs in well KM-8. Well KM-8 frequently exhibited increased turbidity throughout its sampling history. Turbidity was reduced following redevelopment and removal of large amounts of sediment from this well in February 2000.

4.4 Selected Major Ions in Ground Water

4.4.1 Chloride

May 2007 concentrations of chloride are shown on Figure 4-3. The secondary drinking water standard for chloride is 250 mg/l. Reported chloride concentrations in shallow wells range from 5.7 mg/l in KM-1 (previous sampling) to 2000 mg/l (recent) in KM-8. Chloride was predominant in the S-X and scrubber ponds before these impoundments were removed from service. May 2007 ground water chloride concentrations are elevated relative to background near the reclaimed scrubber pond as indicated on Figure 4-3. Wells to the southwest and west of the S-X pond, respectively have near-background chloride concentrations while nearby well KM-8 is two orders of magnitude larger in concentration. Concentrations of chloride in deeper wells, including KM-11 near the former scrubber pond and in wells KM-12 and KM-19 near the former S-X pond range from 9 to 43 mg/l. Chloride concentrations at Finch and Big Spring are 25 and 35 mg/l, respectively. Upper and Lower Ledger Spring chloride concentrations range from 4.2 to 4.8 mg/l and represent background levels.

4.4.2 Nitrate Plus Nitrite

Prior to the October 1995 sampling round, samples were analyzed for nitrate, nitrite, and nitrate plus nitrite. Results indicated that nitrite concentrations are relatively small in comparison with nitrate. Currently, only nitrate plus nitrite is analyzed. The primary drinking water standard of for nitrate is 10 mg/l. Nitrate plus nitrite concentrations at Upper and Lower Ledger Springs is currently 0.44 to 0.87 mg/l, representative of background concentration for the basalt aquifer.

Nitrate plus nitrite concentrations from the May 2007 sampling round are presented on Figure 4-4. Increased nitrate concentrations are centered about well KM-8 to the south of the covered S-X pond, and in another ground water area beneath the site centered to the

south west corner of the calcine cap. Nitrate plus nitrite exceeding 5 mg/l extends beyond the industrial facility boundary to the south and southwest of the site towards well KM-15. Nitrate is noted to be larger than background concentration at Finch Spring (3.2 mg/l) and at Big Spring (4.6 mg/l).

4.4.3 Sulfate

Sulfate indicates a similar ground water trend to chloride and TDS. Concentration distribution of sulfate is presented on Figure 4-5. Reported concentrations of sulfate from the May 2007 sample round range from about 37 mg/l in well KM-19 to 6,700 mg/l in well KM-8. Increased concentrations are centered immediately west of the covered scrubber pond and to the south of the covered S-X pond. Sulfate concentrations in the deeper wells are elevated with respect to background concentration, and range from 64 to 120 mg/l. The secondary drinking water standard for sulfate (250 mg/l) was exceeded in monitor wells KM-3, KM-4 and KM-8. The largest sulfate concentrations in ground water are associated with areas infiltrated by the former S-X raffinate stream. Off-site concentrations of sulfate are elevated above background in wells KM-15 through well KM-18, ranging from 85 to 130 mg/l.

4.5 Selected Metals in Ground Water

4.5.1 Arsenic

Recent ranges of arsenic concentrations in TRONOX monitor wells are summarized in Table 1-2 and are shown on Figure 4-6. Concentrations in ground water range from less than detection in on-site wells to 90 ug/l in well KM-8 near the reclaimed S-X pond. Recent distribution of arsenic in on-site wells shows that arsenic is detected in wells around the reclaimed scrubber pond. Shallow wells KM-2, KM-3 and KM-4 near the former scrubber pond are 10 ug/l or greater in concentration. Samples collected from off-site wells and springs were less than the arsenic method detection limit.

4.5.2 Manganese

Manganese concentrations are decreasing with time in nearly all of the wells. Recent manganese concentrations in TRONOX monitor wells are summarized in Table 1-2, and are shown on Figure 4-7. Recent manganese concentrations in ground water for on-site wells range from less than detection in well KM-19 to 5,000 ug/l in well KM-8. The RBC for manganese (180 ug/l) was exceeded in two POC wells, KM-3 (560 ug/l) and KM-8 (5,000 ug/l). Manganese does not exceed the RBC at off-site well locations. Manganese was reported to be less than the detection limit to 2.6 ug/l at Upper and Lower Ledger Spring. Manganese was also less than the detection limit Finch and Big Springs during May 2007.

4.5.3 Molybdenum

Molybdenum concentrations indicate an overall decreasing trend with time. Recent molybdenum concentrations in TRONOX monitor wells are summarized in Table 1-2 and are shown on Figure 4-8. Molybdenum was a dominant metal in the S-X raffinate stream, and therefore is found in larger ground water concentrations near former pond sources. During May 2007, on-site well concentrations of molybdenum ranged between 23 ug/l in well KM-19 to 41,000 ug/l in well KM-8. Figure 4-8 illustrates that concentrations of molybdenum are elevated in areas centered to the south of the former S-X pond and to the south of the covered scrubber pond. Molybdenum exceeds the RBC (180 ug/l) in all of the on-site wells with the exception of wells KM-9 and KM-19. The molybdenum RBC is exceeded at all off-site TRONOX well locations, and at Finch Spring and Big Spring. Molybdenum was less than the detection limit in Upper and Lower Ledger Spring during May 2007.

4.5.4 Vanadium

Vanadium concentrations in ground water appear to be decreasing with time at most locations, but at a slower rate of concentration change when compared with arsenic, manganese, and molybdenum. May 2007 ground water vanadium concentrations in the TRONOX monitor wells are summarized in Table 1-2 and are plotted on Figure 4-9. Distribution of vanadium in the ground water is similar to nitrate plus nitrite distribution.

Vanadium was a dominant metal in the S-X raffinate stream. Vanadium is detected at concentrations above the RBC (260 ug/l) in all of the on-site wells with the exceptions of intermediate well KM-11 and deep well KM-19. Vanadium concentrations range between 10 ug/l in KM-11 to 18,000 ug/l in well KM-8. Figure 4-9 illustrates similar distribution trends to nitrate plus nitrite concentration in ground water, with the larger concentrations identified near the south end of the reclaimed S-X pond and west of the calcine cap and the covered scrubber pond. Vanadium concentrations in off-site TRONOX monitor wells located southwest of the site exceed the vanadium RBC. Off-site well KM-17 (18 ug/l) remains substantially below the RBC for vanadium.

During May 2007, the vanadium concentration in Finch Spring was elevated (58 ug/l), but much smaller (2.5 ug/l) at Big Spring. Vanadium was less than the detection limit of 10 ug/l in Upper and Lower Ledger Springs.

4.6 Organic Compounds in Ground Water

As noted during the RI (Dames & Moore, 1995), COC semi-volatile organic compounds that include tributyl phosphate (TBP) and total petroleum hydrocarbons (TPH) originated from the No. 1 fuel oil carrier used in the solvent extraction (S-X) process and found in the S-X raffinate stream. These compounds were detected in the former ponds and in the ground water. POC wells were sampled for total petroleum hydrocarbons and for semi volatile compounds for the detection of TBP through 1999. Organics were sampled in all POC wells in May/June 2002 as requested by EPA for evaluation in the 5-year review.

Organics are not sampled at off-site locations. Currently, only well KM-8 is sampled for organics.

4.6.1 Total Petroleum Hydrocarbons

TPH provides screening level estimates of total organic compound concentrations within certain hydrocarbon ranges but does not identify or provide concentrations of specific organic compounds. TPH was analyzed using Method 418.1 through 1999. This method could no longer be used because Freon was discontinued for use in the method by federal regulation. During the May 2007 sampling round, TPH was analyzed using a different extraction under Method SW846 8015B that included analysis for a range of C_{10} through C_{36}.

Recent TPH concentrations in POC monitor well KM-8 are summarized in Table 1-2. TPH concentration in KM-8 during the May 2007 sampling event was 1.5 mg/l, greater than the RBC (0.73 mg/l), but less than previous results for this well.

4.6.2 Tributyl Phosphate

TBP was used in the S-X raffinate stream and was detected at concentrations above the RBC (180 ug/l) in the wells near the reclaimed S-X and scrubber ponds during 1997. Results of previous analyses in off-site wells suggest that TBP does not exceed the RBC downgradient of the plant facility boundary. During a number of sampling events, TBP was not detected. During 1999, TBP was detected only in well KM-8 at 1400 ug/l. During 2000 and 2001, TBP was not detected in well KM-8. It is probable that some of the unknown compounds in KM-8 may be the result of degradation of the TBP compound. In May 2007, TBP was reported to be 590 ug/l in KM-8.

5.0 CONCENTRATION TRENDS WITH TIME

5.1 General

Plots of concentration versus time are shown on the graphs presented in Appendix A. These graphs of routinely sampled well and spring sites present common ion and general indicator trends, including pH, chloride, nitrate plus nitrite, sulfate, and total dissolved solids. Metals concentration graphs include COC parameters arsenic, manganese, molybdenum, and vanadium. During 2007, graphed organic parameters include TBP and TPH from well KM-8 only.

The charts in Appendix A are annotated, where appropriate, to show periods of pond operation, the approximate time that liquid source elimination (LSE) was implemented as a remedial action, and the time that calcine capping was performed. Observed increases and decreases in ground water concentrations shown on the plots result from:

- Process changes during pond operation;
- Liquid source elimination (LSE), removal of pond sediments and pond reclamation that resulted in decreased concentrations;
- Changes in ground water pH;
- Changes in water ground water levels, and subsequent gradients;
- Advective transport and natural attenuation in the aquifer.

Significant process change events are annotated on the graphs of concentration versus time for the wells. Table 5-1 provides a chronology of process and process pond events, and other site events. A number of these events have resulted in increasing and decreasing concentrations in the wells, as well as short-term concentration increases for a few of the COCs following implementation of the site remedy.

5.1.1 Fate and Transport of Graphed Chemical Parameters

Inorganic constituents evaluated versus time include metals and common ions. Constituents can be non-reactive and move through the ground water, unaffected by biotic (metabolism, such as microorganisms) and abiotic (adsorption, ion exchange, precipitation, hydrolysis, redox) processes. The fate of specific compounds ultimately depends on the reactivity or non-reactivity of the chemical with the media during transport.

Common Ions

Graphs of the non-reactive chemicals include chloride, a member of the halogen group that is one of the most commonly detected anions in natural water. The transport of chloride through the ground water is largely through physical (hydrodynamic) processes. Chlorides travel at essentially the same rate as the ground water (Knox et al., 1993); the graphs indicate that chloride concentration changes quickly to modification in plant operations, LSE and reclamation efforts. Chloride ions can form complexes with a few of the positively charged ionic species, however, these complexes are usually weak, and are generally considered insignificant unless chloride concentrations are very large (Hem, 1978). Chloride is considered one of the best tracer elements, and is widely used experimentally in tracer models. In general, chloride does not enter into reduction/oxidation (redox) reactions, does not form solute complexes with other ions, does not adsorb to mineral surfaces and does not form salts of low solubility.

In the absence of plant growth, nitrate behaves as a mobile anion, similar to chloride (Drever, 1988). Nitrate concentrations can be rapidly reduced in surface waters through assimilation by aquatic plants (National Academy of Sciences, 1977). Attenuating factors for nitrates do not appear significant at the site, and concentrations may be reduced primarily through dilution in the aquifer.

The sulfate ion is chemically stable, and forms salts of low solubility with only a few metals (Hem, 1978). Once sulfate has dissolved in water, it generally remains in solution except where it is anaerobically reduced to sulfide, precipitated in sediment, released to the atmosphere, or incorporated into living organic matter.

Metals

Several processes interact to control the reactivity and rate of transport of compounds in ground water. Metal ions can be strongly adsorbed to mineral surfaces in a porous medium (such as a clayey interflow zone in a basalt sequence), or to rock surfaces exposed by fractures. On the other hand, this would inhibit their transport through the aquifer when complexed with other ions; some metals can be transported at average velocities that are orders of magnitude faster than when not complexed because of changes in the attenuation properties for the complexed metal.

Changes in speciation and reactivity can result from encountering different chemistries within the aquifer. The mobilities of different oxidation states of metals such as arsenic, manganese, molybdenum, and vanadium may also differ by order of magnitude (Allen et al., 1993).

In solution at neutral pH, the stable forms of arsenic would be arsenate oxyanions (Hem, 1978), with the dominant form being dependant on the pH of the water. Inorganic factors that maintain low concentrations of arsenic in water include adsorption by hydrous iron oxide, co-precipitation or combination with sulfide.

The transport and partitioning of manganese in water is controlled by the solubility of the specific chemical form of manganese that is present (USHHS, 1990). The solubility and speciation of manganese oxides in solution is largely a function of pH and redox potential. Manganese can also be subject to microbial activity. The principal anion associated with manganese is carbonate, although in waters with large bicarbonate concentrations, manganese bicarbonate complexes can be formed. In waters containing an excess of

1000 mg/l sulfate, manganese sulfate may become the dominant species. In extremely reduced water, the fate of manganese tends to be controlled by the formation of poorly soluble sulfide (USHHS, 1990). The tendency for soluble manganese to adsorb to soils and sediments depends largely on the cation exchange capacity and the organic composition of the soil (USHHS, 1990). Soil adsorption for manganese may be significant in the soils at the site, can be highly variable and can span five orders of magnitude, increasing as a function of organic content and ionic exchange capacity with the soil (Baes and Sharp, 1983). At small concentrations, manganese may become fixed by clays, whereas, at larger concentrations manganese may be desorbed by ion exchange with other ions in solution (USHHS, 1990).

Molybdenum is readily soluble in water, and is likely to be more mobile than vanadium in the ground water. Multiple valence states are a complicating factor in molybdenum chemistry. The anionic (molybdate) species are probably predominant in natural water (Hem, 1978).

Vanadium in the ground water at the site is predominantly found in the pentavalent state. Transport of vanadium in water and soil is influenced by redox potential, pH, and the presence of particulate (USHHS, 1990). Vanadium species have a tendency to bind strongly to mineral or biogenic surfaces by adsorption or complexing; hence it can be transported either in solution or in suspension. Adsorption may be the most significant attenuating factor at the site.

5.2 Trends for On-site and Point of Compliance Wells

5.2.1 Common Ions and General Indicators

Parameters including TDS, sulfate, and chloride indicate similar decreasing trends at the on-site non-compliance and POC wells. The pH is also a general indicator that may be affecting metals trends and concentrations noted at some locations in the past.

Based on a review of concentrations versus time for these parameters, the following general observations are made:

pH

Ground water in the vicinity of the reclaimed scrubber pond had neutral to slightly alkaline pH values through early 1999, relatively unaffected by process waters during plant operation or LSE. Following the summer of 1999, a general decrease in pH was noted in the shallow ground water through 2001 and in a few wells in 2002. The pH rose in these wells following 2002 to the neutral range in 2003. Trends between 2003 and the present indicate the ground water beneath the site is in the near-neutral range, with lowered pH in the ground water near well KM-8 through May 2007.

TDS

TDS concentration trends for ground water in wells located near the former pond facilities are contained in Appendix A. Wells located near the former scrubber pond indicate an increase in TDS concentrations through 1995 and then show generally decreasing concentrations following remedial actions to 2007, with a flattening but decreasing trend between 2000 and the present.

During plant operation, increases in TDS concentrations between 1993 and 1995 are attributed to the diverted discharge of the S-X stream into the scrubber pond instead of discharging to the S-X pond. During 1997, the scrubber pond liquid was pumped to the calcine pond in preparation of the scheduled remedial action for this facility. Incidental residual liquid in the scrubber pond was released from the pond near the location of well KM-3 during the stabilization of the scrubber pond solids. As a result, well KM-3 TDS concentrations spiked during 1997 from the effects of the residual liquid ponding at the surface in the near vicinity of the well. TDS concentrations in well KM-3 have decreased since November 1997 following pond closure and reclamation, but ground water

concentrations appear to show seasonal variability between 2000 and the present, unlike other shallow wells in this area.

Shallow wells near the former scrubber pond demonstrated a greater degree of variability in TDS concentrations between sampling events prior to pond closure. All wells continue to indicate overall decreasing trends, although concentrations rose slightly in May 2006. Seasonal increasing/decreasing trends may account for some of the variability between rounds. Intermediate depth well KM-11 demonstrated little variability.

Wells KM-5, KM-9, KM-12, and KM-13 located near the west side of the facility or near the reclaimed S-X pond indicate a general TDS concentration decrease with time, and smaller overall decreases following 2000 as concentrations approach background. Well KM-6 indicated slightly increasing concentrations through 1999, followed by a decreasing TDS trend through 2002, and a flattening of the trend between 2001 and the present. Deep well KM-19 is near background concentration with respect to TDS. Well KM-8 indicates substantial variability with time, and suggests an overall decreasing trend between 1995 and 2005. TDS increased slightly in well KM-8 between 2005 and 2007. Seasonal increasing/decreasing trends may account for some of the variability between rounds.

Chloride

Chloride concentration trends for wells located near the former pond facilities are contained in Appendix A. Currently, chloride concentrations are substantially greater near the scrubber pond than at other site locations, except KM-8.

Ground water in the vicinity of the reclaimed scrubber pond shows an increase in chloride concentration for shallow wells during pond operation through 1995 as a result of S-X stream discharges to this location. Chloride concentrations have decreased to the present. Shallow wells display variable chloride concentrations through 1997

between sampling events as the result of unlined pond operations. Intermediate depth well KM-11 is less affected by pond operational changes and indicates a more even (smoother) trend with time. All wells in this area demonstrate decreases in chloride concentrations between November 1997 and the present. The decreasing chloride trend in KM-2 slowed after 2003. Chloride concentration trends are nearly identical to TDS trends.

Wells located near the west side of the facility or near the former reclaimed S-X pond indicate chloride concentration decreases with time, with a general flattening of the trends since 2001. Well KM-6 chloride concentrations are also decreasing, but remain elevated above other wells in this area. Chloride in wells KM-5 and KM-6 have increased slightly since 2004. Well KM-8 chloride concentrations show seasonal variability with larger concentrations in the fall, but generally decreasing concentrations through 2000, followed by a lack of seasonality in the data to the present. Concentrations of chloride increased slightly between 2005 and 2007 in well KM-8.

Sulfate

Sulfate concentration trends for wells located near the former pond facilities are contained in Appendix A. Sulfate trends for wells located near the reclaimed scrubber pond show decreasing trends that are comparable to chloride. An increase is noted in sulfate concentrations through 1996 as a result of S-X stream discharges to this location. Sulfate shows a general decrease to the present. Concentration increases in well KM-3 in 1997 resulted from incidental residual liquid in the scrubber pond that was released from the pond during remediation and reclamation. As the direct result, concentrations of sulfate in well KM-3 spiked during 1997. KM-3 sulfate concentrations decreased since that time. Sulfate concentrations in wells KM-2 and KM-11 have been relatively steady between 1999 and the present. Sulfate concentrations in well KM-4 indicate decreasing concentration trends since 1997. Well KM-11 was less affected by plant operations, and shows an even (smoother) trend with time and a longer duration of peak sulfate concentrations.

Wells KM-5, KM-9, KM-12, and KM-13 near the west side of the facility or near the former S-X pond demonstrate a concentration decrease with time with a flattening since 2000. Well KM-19 sulfate concentrations decreased to near background concentrations in 1998. Well KM-6 indicated little change with time through 2000, and then began to decrease though 2004, and then rise slightly to the present level. Well KM-8 sulfate concentrations vary with time similar to chloride and TDS trends. Well KM-8 sulfate continued to indicate decreasing trends between 1995 and 2005. Slight increasing concentrations are noted between 2005 and the present. Less seasonal variability in concentration is noted between 1999 and the present. Increased concentrations were noted in the fall during periods of lower water level elevations in this well prior to mid-2000.

Nitrate plus Nitrite

Nitrate plus nitrite concentration trends for wells located near the former pond facilities are contained in Appendix A. Wells KM-3 and KM-11 located near the reclaimed scrubber pond show like concentrations and trends, and a relatively flat trend since LSE was implemented. Well KM-2 shows higher nitrate plus nitrite ground water concentrations than KM-3 and KM-11, with declining concentrations between 1999 and 2003, then a flat with a spike in concentration occurring in 2006. Well KM-4 nitrate plus nitrite concentrations indicate an increasing concentration trend beginning in the fall of 2001 through the present. Current concentrations are within the range of concentrations noted during plant operations in well KM-4.

Shallow wells near the west side of the facility or near the former S-X pond indicated a spike in nitrate plus nitrite concentration between 1993 and 1994 and variable concentrations with time. Most wells show a decrease in nitrate plus nitrite concentration between 1997 through May 2000. Concentrations in KM-5 and KM-6 suggest an increasing trend between 2001 to the present. KM-7 concentrations peaked in 2006 and dropped in 2007. Wells KM-13 and KM-9 also suggest slightly increasing

nitrate concentration since 2004. Deeper wells KM-12 and KM-19 indicate little change with time. Well KM-8 concentrations spiked in 1994 and 1997, and indicated a decreasing trend through 2001. An increasing nitrate trend is noted in KM-8 between 2001 and 2007.

5.2.2 Metals Concentration Trends

Graphs of metal concentrations versus time include the group of metals identified by EPA as COC. COC metals versus time are presented in Appendix A and described in the following sections.

Arsenic

The risk based concentration (RBC) is 50 ug/l for arsenic is based on the ROD. However, during a meeting at the Tronox site in July 2007, the EPA intended to reduce the performance RBC standard to 10 ug/l. On January 22, 2001, EPA adopted a new drinking water standard or maximum contaminant level (MCL) for arsenic of 10 ug/L or 0.010 mg/L, effective January 2006. Based on the most current results, wells KM-2, KM-3 and KM-8 exceed the new EPA standard for arsenic.

Wells located near the former scrubber pond are near the RBC (10 ug/l). Well KM-3 shows a slight increase in arsenic through 1997, primarily during the time-period that the S-X stream was diverted to the scrubber pond. Well KM-2 spiked in 1994 and has decreased since that time. Well KM-4 spiked in 1994 and again during 1997. Concentration spikes may have been related to discharge of the S-X stream to the scrubber pond. Arsenic concentrations have generally been decreasing near the former scrubber pond since LSE and reclamation in 1997, with a flattening of the trend since 1999.

Wells near the west side of the facility or near the former S-X pond indicate an arsenic concentration decrease with time through 1995. Sample results from the October 2007

sampling will use lower detection limits and allow for a better understanding as to the arsenic trend which are less than the current reporting limit.

Well KM-8 indicated an increasing trend between May 1995 when the pond was taken out of service and 2002. The cause for the increase in arsenic concentrations since closure of the S-X pond is unknown. Concentrations of arsenic have decreased between 2002 and May 2006. Concentrations increased again in 2007.

Manganese

Wells located near the former scrubber pond show variable manganese concentrations throughout operation and then small decreases to the present. Increases in the concentrations of manganese during earlier time periods are attributed to S-X stream discharge into the scrubber pond. Wells KM-3 and KM-4 show significant variability between sample rounds through 1997. KM-4 manganese concentrations spiked during 1994 and decreased through the present. Manganese concentrations in well KM-3 spiked during 1997 then decreased with time though 2000. KM-3 is the only well in this group that currently exceeds the RBC for manganese, and indicates steady increasing concentrations between November 2000 and May 2007.

Wells near the west side of the facility or near the former S-X pond indicated a decrease in manganese with time between 1995 and 2000. Trends for manganese have flattened from 2000 to the present, although KM-7 continues to decrease. Well KM-6 indicates considerable variability with time that suggests seasonal trends, although this was less notable between 2002 and 2004. KM-6 indicated an increasing trend between 2004 and 2006 with falling concentrations to the present. Well KM-19 is about at background concentration.

Well KM-8 continues to exceed the RBC for manganese. The KM-8 manganese trend shows decreasing concentration through 1994, and increasing concentrations through 1997. Concentrations of manganese have fluctuated, but generally began to decrease

several years following LSE and reclamation efforts in 1997. Manganese concentrations have risen since 2004 to the present in KM-8.

Molybdenum

Molybdenum concentration trends for wells located near the former pond facilities are contained in Appendix A. Molybdenum trends with time are comparable to sulfate trends. Wells located near the former scrubber pond indicated decreasing molybdenum concentrations with time following LSE and reclamation through 2000. With the exception of wells KM-3, the remaining wells have all indicated slightly decreasing molybdenum concentrations following 2000 to the present. Wells KM-3 molybdenum concentrations have remained steady or showed slight increases between 2000 and 2007. Molybdenum concentrations in well KM-3 spiked in 1997 during the remediation and stabilization of the scrubber pond solids.

Wells KM-5, KM-9, KM-12, KM-13, and KM-19 near the west side of the facility or near the reclaimed S-X pond indicate a concentration decrease with time through 2000, with nearly flat trends to the present. KM-6 indicates an overall decreasing molybdenum trend through 2004, and an increasing molybdenum trend between 2004 and May 2007. Increased concentrations occur during periods of higher water level elevation (spring sampling) in this well.

Molybdenum concentrations in well KM-8 peaked during late 1994. Well KM-8 indicates substantial concentration variability with time similar to the common ion trends and an overall decreasing trend with time following LSE and reclamation events. Trends have been slowly decreasing with little seasonal variation since 2000. Molybdenum concentrations spiked in KM-8 in the spring of 2005, but increased between 2006 and 2007.

Vanadium

Vanadium trends in wells located near the former pond facilities are contained in Appendix A. Shallow wells located near the reclaimed scrubber pond indicate decreasing vanadium concentrations with time following LSE in 1997. Well KM-11 is an order of magnitude below the RBC, and indicates little change since 1997. KM-3 indicates a flattening of the vanadium concentration between May 1998 and May 2001, and a steady or slightly decreasing trend following capping of the calcine. Well KM-4 vanadium concentrations increased substantially through 1997 and decreased with time through early 2000. Well KM-4 vanadium concentrations have increased since 2004 with a large spike in concentration in 2006. Well KM-2 vanadium concentrations increased through 1996 as the result of the S-X discharge to the scrubber pond, and decreased substantially in 1997 when the pond was reclaimed and the calcine pond dried. Vanadium concentrations in KM-2 have risen slightly since 2004.

Wells KM-5, KM-8, KM-9, KM-12, KM-13, and KM-19 located near the west side of the facility or near the reclaimed S-X pond indicate a concentration decrease with time through 2000 or 2001. This decreasing trend flattened through 2007. Wells KM-5, KM-6 and KM-7 have larger ground water vanadium concentrations than other wells in this group (except KM-8). These wells all spiked in 2006. Concentrations of vanadium in KM-6 have generally risen since 2004

Well KM-8 vanadium concentrations began to decrease in KM-8 beginning in 1992 and continue to decrease following LSE in 1997. In May 1998, vanadium concentrations began to increase in KM-8 with an increasing trend through 2004. Concentrations decreased between 2004 and 2006, but rose again in 2007.

5.2.3 Organics

Total Petroleum Hydrocarbons

KM-8 is the only POC well routinely sampled for TPH. TPH concentrations with time for well KM-8 are contained in Appendix A. Concentrations of TPH decreased with time in well KM-8 to less than detection in 1999. During 2000 and 2001, TPH concentrations appear to have increased above historic ranges. Concentrations have decreased since 2000 to current levels of about 1.7 mg/l.

Tributyl Phosphate

KM-8 is the only POC well routinely sampled for TBP. TBP concentrations with time for well KM-8 are contained in Appendix A. Concentrations of TBP decreased through 2005 in well KM-8 following covering of the S-X pond. Concentrations appear seasonal, with larger concentrations generally noted in the spring sampling events. Concentrations have been within the same seasonal range since 2004.

5.2.4 Conclusions of On-Site Well Concentration Trends

Conclusions drawn from the review of on-site well concentration trends include:

- Nearly all on-site wells exceed the RBC for molybdenum and vanadium. Nearly all wells demonstrate decreases in concentration with time, although the decreasing trend for some general indicators and metals has flattened since 2003. Some increases have been noted in a few wells since 2004.
- Concentrations of common ions have generally decreased through 2007 in almost all POC wells following LSE and surface reclamation. Slight increases were noted in several wells in 2007.
- Concentrations of manganese declined following LSE and reclamation to less than the RBC in all on-site wells with the exception of KM-3 and KM-8 that currently demonstrate rising concentration trends.

- Several shallow wells indicate seasonal variability in concentration. For some wells, including KM-6 and KM-8, this seasonal trend diminished between 2002 and 2007.

- TPH continues to slightly exceed the RBC in KM-8, although trends indicate a decline in concentration that is approaching the RBC.

- TBP is currently detected in KM-8, although this TIC was not noted between 1998 and 2001. TBP is also continuing an overall trend of declining concentration.

- Arsenic remains above detection and the revised drinking water arsenic MCL in several shallow ground water wells around the covered scrubber pond and in well KM-8.

- Well KM-8 indicates vanadium concentration increases between 1998 and 2004 but a decreasing trend through 2006. An increasing vanadium trend is noted in KM-6 between 2004 and 2007. A number of wells indicate increased vanadium concentrations in May 2007.

5.3 Off-Site Well Concentration Trends

The following sections provide a discussion of concentration trends with time for the off-site wells (TRONOX wells located beyond the POC), located to the south on the property previously owned by Larry Hopkins, but purchased by TRONOX in 2004. Off-site wells that are now on TRONOX property include KM-15, KM-16, KM-17, and KM-18. Changes in concentration with time are generally smaller in the off-site wells as a function of their greater distance from the site and pond areas that impacted ground water quality.

In general, concentrations and concentration trends observed in paired shallow and intermediate wells KM-15 and KM-18 are nearly identical for a number of parameters. Concentrations decreased steadily in these wells since the time of the remediation of the MAP ponds in 1993. Wells KM-15 and KM-18 appear to be more directly affected by activities on the west side of the plant facility. Well KM-16 indicates seasonal fluctuations and demonstrates more of a delayed response to LSE and pond basin remediation performed between 1995 and 1997. Well KM-17 has been impacted by operations that occurred in the vicinity of the former scrubber pond. Well KM-17 has

large concentrations of common ions, but appears minimally impacted by arsenic, manganese, and vanadium.

5.3.1 Common Ions and General Indicators

Based on a review of concentrations versus time for these parameters, the following general observations are described below. Graphs of concentrations versus time are contained in Appendix A.

pH

Off-site indicate a similar trend to on-site wells, with a general decrease in pH noted in late 1999 through 2001 from previous neutral to slightly alkaline conditions. The pH in the ground water was slightly less than or near neutral in 2007 in wells KM-15, KM-16 and KM-18.

TDS

Paired wells KM-15 and KM-18 have similar TDS concentrations, and show an overall decrease in concentration with time through 2004. Well KM-16 indicates a decreasing trend with time following LSE, but increasing TDS since 2004. Seasonal trends may account for some of the variability between rounds; however, this is less notable following 2000. Increased concentrations occur during periods of higher water level elevation in this well. Well KM-17 has the largest of the off-site well TDS concentrations.

Chloride

Wells KM-15 and KM-18 indicate matching concentrations, and show an overall decrease with time through 2003. The trend has become flat between 2003 and 2007. Wells KM-16 and KM-17 indicate a more direct response to LSE than wells KM-15 and KM-18, which indicated an earlier decrease in chloride. KM-16 indicates a larger

decrease following 1999, but may be increasing since October 2003. Well KM-17 chloride concentrations are the largest identified in the off-site wells. This well has been affected by lateral dispersion from the scrubber pond, and indicates variably decreasing concentrations since pond reclamation in 1997.

Sulfate

Wells KM-15 and KM-18 indicate nearly identical concentrations, and show an overall decrease with time since initial sampling in 1992. This trend flattened in 2000. Well KM-17 sulfate concentration trends appear to be decreasing following LSE and scrubber pond reclamation efforts in 1997, although KM-15, KM-16 and KM-18 have been relatively flat since 2004.

Nitrate plus Nitrite

Concentrations of nitrite plus nitrate decreased following LSE in the off-site wells. Well KM-15 nitrate plus nitrate concentrations spiked during May 1993, then decreased through 2001. Well KM-18 nitrate plus nitrate concentrations spiked during May 1994, then decreased to the recent KM-15 concentration. Well KM-16 indicates a decreasing trend with time, and seasonal increasing/decreasing trends. Concentrations of nitrite plus nitrate increase during periods of higher water level elevations in this well, although this has become less notable since 2000. Well KM-17 demonstrates the smallest variability with time, but indicates an overall decreasing trend. Wells KM-15, KM-16 and KM-18 demonstrate a rising trend since 2001 and seasonally variable concentrations.

5.3.2 Off-Site Metal Concentration Trends

Graphs of metal concentrations versus time include the group of metals identified by EPA as COC. COC metals versus time are presented in Appendix A and described in the following sections.

Arsenic

All off-site wells are well below the detection limit and the RBC for arsenic. Off-site wells are less than the detection limit of 10 ug/l.

Manganese

Off-site wells are below the RBC for manganese. Concentrations of manganese in well KM-15, KM-16, and KM-18 decreased with time from initial concentrations that were greater than the RBC. Well KM-17 manganese concentrations remain low, near the detection limit. Well KM-16 indicates an overall even but slightly decreasing trend with time and seasonal trends between rounds. This trend is less notable since 2000. Increased concentrations occur during spring sampling rounds. Decreases in manganese concentrations in KM-16 show a lag time behind the other off-site wells, and a flattening of the trend is noted beyond 2003.

Molybdenum

All off-site wells currently exceed the RBC of 180 ug/l. Concentrations of molybdenum in wells KM-15 and KM-18 peaked prior to 1995 during pond operation and began to decline after diversion of the S-X stream to the double-lined ponds. Both wells have similar concentration trends and both indicate significant concentration decreases with time through 2000. The trend has flattened somewhat between 2000 and 2007. Well KM-16 indicated a steady molybdenum concentration with time through 1997. Molybdenum concentrations decreased in May 1998, approximately six months following LSE and pond reclamation. Well KM-16 indicated seasonal increasing/decreasing trends through 2001. Increased concentrations occurred in the spring during periods of higher water level elevation. KM-16 molybdenum concentrations slightly increased between 2004 and 2006, and then decreased again in 2007. KM-17 molybdenum concentrations increased between 1998 and 2003 then declined slightly to the present concentrations.

Vanadium

Off-site wells exceed the RBC for vanadium with the exception of well KM-17, which has relatively unchanged concentrations since November 1997. Concentrations of vanadium in wells KM-15 and KM-18 peaked prior to 1993 and began to decline after diversion of the S-X stream to the scrubber pond and elimination of the MAP ponds. Both wells have parallel decreasing concentration trends, with well KM-18 having a consistently lower concentration. Both wells indicate considerable concentration decreases with time through 2000, with a flattening of the trend in 2005. Well KM-16 has the largest vanadium concentration of all off-site wells, and most recently indicates an increasing concentration trend between 2004 and 2006.

5.3.3 Organics

Organics are no longer sampled in the off-site wells. TPH was last sampled during November 1996. Concentrations of TPH remained relatively unchanged with time. Concentrations of TPH during 1996 were reported at the detection limit. TBP concentrations increased through May 1994 in the off-site wells, and then decreased to less than the RBC in October 1995. TBP in well KM-16 was not detected after May 1993.

5.3.4 Conclusions of Off-Site Well Concentration Trends

Conclusions drawn from the review of off-site well concentration trends include:

- Off-site wells exceed the RBC for molybdenum and vanadium (except KM-17 for vanadium), but are below the RBC for arsenic, manganese, and assumed to be below the RBC for organics. Concentrations are indicated to decrease with time following LSE, with the exception of metals concentrations in KM-16 which indicate increases between 2004 and 2006.

- Concentrations of common ions and TDS continue to generally decrease with time following LSE and reclamation. Nitrate plus nitrite concentrations have been rising

in general since 2001 with the exception of KM-17. Concentrations of common ions have flattened or risen in KM-16 between 2004 and 2006.

5.4 Off-Site Surface Water Quality Concentration Trends

TRONOX routinely monitors surface water quality at four spring locations. Sampled springs include Finch Spring, Big Spring, and Upper and Lower Ledger Springs. Finch Spring originates from the base of the Finch Spring Fault scarp, approximately 4000 feet to the south of the TRONOX facility. Finch Spring has been routinely sampled since 1991.

Big Spring is the most distant spring relative to the site, located approximately 4 miles south of the facility and south of the town of Soda Springs and is believed to be impacted from several upgradient sources, including the Monsanto facility. Big Spring emerges from alluvium at the south end of the valley floor and flows into Hatchery Creek and then into the Bear River. Big Spring was first sampled by TRONOX in 1993. Flow from this spring is considerably greater than Finch Spring, although this flow was smaller between 2001 and 2004 due to several years of below normal precipitation. Discharge from Big Spring was approximately 17.6 cfs in May 2007, whereas discharge from Finch Spring ranges from about 10 to 40 gpm. Springs are sampled for general indicator parameters, common ions, and metals. Concentrations versus time graphs for these springs are presented in Appendix A.

Upper and Lower Ledger Spring surface approximately 3300 feet to the southeast of Finch Spring and issue from basalt. During June 2000, EPA requested TRONOX resume routine sampling of Upper and Lower Ledger Springs. These springs were first sampled by TRONOX in 1991. These springs are a source of drinking water for Soda Springs. Sample results with time are presented for Upper and Lower Ledger Springs in Appendix A. Concentrations of metals are typically less than detection in Upper and Lower Ledger Springs, although molybdenum and vanadium are infrequently detected at concentrations near the detection limit.

5.4.1 Common Ions and General Indicators

TDS

TDS concentrations at Finch Spring increased through October 1994 as the result of pond operation at the site and changes in the discharge of the S-X stream. TDS concentrations decreased steadily between 1995 and 2002, with a smaller seasonally-affected decreasing trend between 2002 and 2007.

Big Spring is located at the most downgradient discharge point in the valley, adjacent to the Bear River. Small seasonal trends are noted in the Big Spring TDS data. Concentrations of TDS at Big Spring decreased consistently since 1996 to current levels (630 mg/l) that are comparable to, but slightly greater than Finch Spring. TDS concentrations decreased in Big Spring between 1995 and 2002. Between 2002 and 2007, the decreasing trend became smaller with notable seasonality in the data.

Ledger Springs TDS concentrations were 470 mg/l in May 2007. Lower Ledger generally has indicated slightly larger concentration than Upper Ledger in past sampling events. TDS concentrations at the Ledger Springs are less than the concentrations at Big and Finch Spring, and are more representative of background water quality concentrations. Concentrations appear seasonal, and trends suggest generally decreasing TDS concentration since 2000.

Chloride

Concentrations of chloride at Finch Spring increased through October 1994, peaked again in late 1996, and then decreased in concentration through May 2007 below 1991 levels. Concentrations leveled off in 1999 but then continued a decrease through the present. Chloride is a conservative tracer because transport in ground water is generally through the hydrodynamic process, traveling essentially at the same rate as

ground water flow. Therefore, changes in chloride concentrations at Finch Spring reflect process and remedial changes at the plant.

Chloride concentrations decreased in Big Spring after 1996. Big Spring is located at the most downgradient discharge point in the valley, and decreasing concentrations of chloride may be related to factors affecting water quality not related to the TRONOX facility. The decreasing chloride trend flattened between 2001 and 2007, but continues to decrease with time. The chloride concentrations at Ledger Springs are an order of magnitude less than chloride concentrations at Big and Finch Springs. Chloride concentrations range between about 4 to 6 mg/l.

Sulfate

Sulfate trends at Finch Spring are remarkably similar to the chloride trends. Sulfate peaked in October 1994 and 1996 and decreased to the present concentrations. Changes in Finch Spring sulfate concentrations are related to former S-X stream discharges to the scrubber pond. Concentrations of sulfate at Finch Spring decreased in 2007 to within or below the range of 1991 concentrations. Sulfate trends are essentially flat since 2005. Sulfate concentrations at Big Spring are about double the Finch Spring concentration. Big Spring also indicates a steady decrease with time through 2004, with the current trend essentially flat. The Ledger Springs sulfate concentrations are also lower than Big and Finch Springs, and range from about 30 to 34 mg/l. No trends are noted for sulfate in Ledger Springs.

Nitrate plus Nitrite

Nitrate plus nitrite concentrations are similar at Finch and Big Springs locations, with slightly larger concentration at Big Springs. Both locations suggest slight seasonal trends in the data, with larger concentrations occurring in the fall season. Both locations indicate generally decreasing concentration trends with time through 2001 and a flattened trend between 2001 and 2007. Ledger Spring nitrate plus nitrite

concentrations are an order of magnitude lower than concentrations at Big and Finch Springs, and range between 0.2 and 0.8 mg/l. Nitrate indicates small increasing trends at both springs since 2004.

5.4.2 Metals Concentration Trends

Graphs of metals versus time are presented in Appendix A and described in the following sections.

Arsenic

Arsenic concentrations are less than the reporting limit at all spring surface water locations during 2007.

Manganese

Concentrations of manganese are generally less than, or near the reporting limit at Finch Spring. Concentrations of manganese are 2.6 ug/l at Upper Ledger Spring, and less than detection at all remaining sampled spring locations in May 2007.

Molybdenum

Historic increases and decreases in molybdenum concentrations for Finch Spring were related to changes in the discharge locations of the S-X stream. Concentrations of molybdenum at Finch Spring indicate decreasing trends through 1996. The concentration then increased sharply and peaked in July 1997. Concentrations of molybdenum decreased steadily between 1997 and the 2007.

Molybdenum concentrations increased at Big Spring through 1997 then decreased through 2000. Concentrations of molybdenum increased slightly in 2001, also noted at Finch Spring. The trend in molybdenum flattened in 2003, then continued an overall

decreasing trend through 2007. These trends may reflect, in part, some of the earlier LSE changes made at the plant.

Molybdenum was estimated less than detection at the Ledger Springs in May 2007. Molybdenum has been detected infrequently at levels near or below the reporting limit since 2000.

Vanadium

Vanadium concentrations increased at Finch Spring through 2001. Concentrations of vanadium peaked in Finch Spring during 2001 at 92 ug/l and then began a decreasing trend to 58 ug/l in 2007. Increases in vanadium concentrations at Finch Spring are believed to be the result of operational S-X stream discharges to the scrubber pond. Vanadium concentration at Big Spring was 2.5 ug/l in 2007. Vanadium was not detected at the Ledger Springs in May 2007.

6.0 PROJECTED CONCENTRATION DECAY TRENDS

This section presents an analysis using existing ground water monitoring data to project future trends, and provides an estimate when these concentrations may potentially fall below their respective RBC for molybdenum and vanadium. TBP, and TPH are less than the RBC for all wells except KM-8, and therefore are not considered in this analysis. Arsenic, frequently found to be less than detection in most wells after 1999 is also not projected. There is no clear trend for arsenic in well KM-8 that demonstrates the largest ground water concentration. Manganese is evaluated only for KM-8 because KM-3 demonstrates an increasing trend with time and other wells demonstrate manganese concentrations that are currently less than the RBC.

Projected concentration decay trends are estimated where possible, using a regression trend curve fitted to the real-time monitoring data from wells where the COC currently exceed the risk-based concentration. Only wells exhibiting a decreasing concentration following LSE are considered in the analysis for the projection of concentration decay. This group includes wells on-site wells KM-2, KM-3, KM-5, KM-6, KM-8, KM-9, KM-12 and KM-13; and off-site wells KM-15, KM-16 and KM-18. Results of the analysis are summarized in Table 6-1. Decreasing molybdenum and vanadium trends were less evident in several wells, in part due to increasing trends or recent increasing concentrations in some wells. Most of the wells, both on and off the industrial site demonstrate predictable decreases.

COC concentration trends with time and projected trends for these wells are presented in Appendix B. The time-period selected for each well location varies slightly, and was based on LSE completed in the closest pond basin, or completion of reclamation of a pond basin (annotated on the graphs). Projected trends are based on the post-LSE monitoring period data. The projected period is through the year 2020. This year was selected based on a time length of approximately 25 years after the S-X stream was contained within lined ponds.

6.1 Analytical Method

Existing ground water data were evaluated using a statistical forecast function for exponential decay. A forecast calculates or predicts a future value by using existing values. The predicted value is a y-value (future concentration of a COC in ground water) for a given future date. The known values are ground water data from the wells. A forecast statistically predicts future values based on a regression function of a range of known data or known x- and y-arrays. Regression analysis estimates the relationship between variables, so that a given variable can be predicted from one or more other variables.

Data curves for the ground water concentrations were generated using an exponential function that describes decay of a substance and calculates the least squares fit through points by using the equation:

$$y = ce^{-kt}$$

where:

e is the base of the natural logarithm;

c is a constant at y_0 (initial concentration) at $t = 0$, and;

$^{-kt}$ is a constant for the predicted time, with the minus sign representing decay of concentration with time.

A trendline is generated for the data based on known x-values for the best-fit curve. The y intercept for the regression trendline is set at zero. This is appropriate, based on the observed absence of manganese, molybdenum and vanadium in background ground water quality data.

6.2 Results of Trendline Analysis

Results of the trendline analysis are presented on the graphs in Appendix B. It is possible that future ground water concentration trends may differ from results generated using real-time data. A number of factors can potentially affect future ground water concentrations and trends. These factors may include, among others, changes in ground water pH, significant changes in precipitation, infiltration and site runoff, capping of the calcine, and significant changes in ground water levels related to variable annual rainfall totals.

The minimum range of each graph has been set at the respective RBC where the 2007 ground water concentration exceeds the RBC. Analysis of the forecast trends suggests the following:

- Wells KM-5 and KM-9 were reduced to the RBC for molybdenum in 2003 as predicted by use of these trendlines. However, a recurring exceedence of molybdenum in 2005 and 2006 was observed. Well KM-5 slightly exceeded the RBC in 2007

- Analysis of 2007 data indicates that in most cases, molybdenum and vanadium concentration decreases lag predictions made in 2006 for several of the wells by one or more years, largely resulting from flattening or recent small increases in vanadium and molybdenum noted in the discussion of concentration trends.

- Molybdenum concentrations will continue to decline in most wells in response to LSE and reclamation. Wells KM-12, KM-13, KM-15, KM-17 and KM-18 are projected to fall below the RBC between 2008 and 2015. Wells KM-2, KM-3, KM-6, KM-16 and KM-8 are estimated to fall below the RBC beyond 2015 based on current trends.

- On-site wells and several off-site wells are forecast to exceed the vanadium RBC for a period of ten years or greater following remedial actions completed in 1997. Based on current trends, wells KM-9 and KM-13 are the first wells expected to fall below the vanadium RBC between 2009 and 2011.

- Manganese is estimated to potentially exceed the RBC in POC well KM-8 for greater than 15 years following LSE, in part as the result of a recently rising manganese trend. Well KM-3 will exceed the RBC for an uncertain period. The rising manganese trend in well KM-3 is not occurring in other wells monitoring the covered scrubber pond area.

7.0 CONCLUSIONS

During 1997, TRONOX discontinued discharges from unlined ponds to ground water. Analysis of real-time monitoring data indicates that remediation efforts of the ponds prior to and during 1997 resulted in notable ground water quality improvement at most of the on-site, POC, and off-site well locations. Predicted trends (water quality projections based on real-time monitoring) suggest that a number of TRONOX well locations have the potential to drop below the RBC for vanadium and molybdenum within 10 to 20 years following LSE. Other wells indicate longer periods of time before concentrations fall below the RBC.

Based on a review of water quality through May 2007, recent water quality trends, and predictions of future concentrations, the following conclusions are drawn.

On-site Water Quality Conclusions

- Generally, concentrations of common ions and TDS have decreased with time in the on-site wells. This trend has flattened somewhat between 2000 and the present for a number of the on-site wells near the west side of the facility as these concentrations approach background.

- Increasing concentrations at several wells following 2004 are in part related to rising water levels in the aquifer following years of drought. Seasonal concentration trends noted in some well locations, including KM-6 and KM-8 also appear to be directly related to changes in water levels. These seasonal effects are less discernable between 2001 and in 2007.

- A rising nitrate trend is noted at most well locations near the covered S-X pond. Nitrate plus nitrite concentrations have doubled in well KM-8 between 2001 and 2007. Rising nitrate plus nitrite is also noted in shallow well KM-4 west of the calcine cap and the covered scrubber pond.

- Vanadium and molybdenum continue to exceed the RBC at most of the on-site POC wells and non-POC wells. Wells KM-5 and KM-9 fell below the molybdenum RBC in 2003, but continue to track close to the RBC. Molybdenum and vanadium concentrations are generally decreasing with time in nearly all POC wells, although KM-3 continues to indicate elevated molybdenum levels since 2000.

- A decreased pH in the ground water between 1999 and 2001 may have caused increased metals concentrations in some POC wells during that period. The pH is now near-neutral across the site and at off-site locations, with the exception of well KM-8.

- Concentrations of TBP and TPH slightly exceed the RBCs in well KM-8 ground water. TPH indicates a decreasing ground water trend through 2005 with little change to the present. TBP indicates an overall decreasing trend since LSE was implemented in 1997 through 2004 with a seasonal pattern within this range to the present.

- Arsenic is less than detection at most on-site wells and was identified at small concentration in shallow ground water. Concentrations of arsenic in ground water are above 10 ug/l near the reclaimed scrubber pond. Arsenic concentrations increased between May 1995 and 2002 in the ground water monitored by KM-8, and declined through 2005. Arsenic is less than detection at off-site well locations.

- Manganese concentrations decreased with time in nearly all wells following LSE and remedial actions completed in 1997. Manganese currently exceeds the RBC in two POC wells. Well KM-3 indicates an increasing manganese trend following implementation of LSE. Well KM-8 manganese concentrations are seasonal. Concentrations decreased substantially between 1997 and 2004, but currently are increasing and remain an order of magnitude above the RBC.

- On-site deep well KM-19 was below the RBC for all COC in 2007.

- Predicted water quality for many of the POC wells suggest that molybdenum and vanadium concentrations will exceed the RBC for 10 or more years following LSE.

Off-Site Ground and Surface Water Quality Conclusions

- Generally, common ions and TDS decreased with time in the off-site wells, but this trend appeared to flatten in 2003.

- Increasing concentrations for several constituents in well KM-16 following 2004 appear related to rising water levels in the aquifer following years of drought.

- Concentrations of common ions and TDS decreased in well KM-17 since peaking in 1998. Molybdenum indicates a decreasing trend in this well. Vanadium is less than the RBC.

- Vanadium and molybdenum continue to exceed the RBC in most of the off-site wells. Molybdenum concentrations continued to decrease through 2004 where a

relatively flat trend is noted to May 2007. Vanadium concentrations are also decreasing in KM-15 and KM-18, although vanadium increased in KM-16 between 2004 and 2006.

- Arsenic is less than detection at all off-site well locations.
- Manganese continues to decrease at off-site locations and is less than the RBC at all locations.
- Finch and Big Spring exceed the RBC for molybdenum only. Both locations continue to indicate decreasing trends.
- Vanadium concentrations in Finch Spring are less than the RBC, and vanadium is less than the reporting limit in Big Spring.
- Vanadium concentrations at Finch Spring increased between May 1993 and October 2003. A peak vanadium concentration occurred in October 2001. Concentrations of vanadium have decreased at Finch Spring since that time.
- Water quality at Upper and Lower Ledger Springs does not appear to be impacted from former site operations based on May 2007 water quality results.

COC Trendline Predictions

- Wells KM-5 and KM-9 met the molybdenum RBC as predicted in 2003. However, concentrations of molybdenum in both wells continue to hover near the RBC.
- Molybdenum is projected to fall below the RBC in three of the downgradient POC wells within ten to fifteen years following LSE. Molybdenum concentrations will continue to exceed the RBC at the on-site wells KM-2, KM-3, KM-6 and KM-8 for considerably longer.
- The concentration of vanadium is projected exceed the RBC in most on-site POC wells and off-site wells for fifteen years or more following 1997 LSE actions, with the exception of KM-19 which is already below the RBC. Wells KM-9 and KM-13 are predicted to be near the vanadium RBC within about ten to 15 years following LSE.
- As a result of overall larger concentrations and unclear trends for arsenic and vanadium concentrations, well KM-8 continues to lag other wells in concentration decreases. Therefore, KM-8 will take considerably longer to fall below the RBCs for manganese, molybdenum and vanadium.

8.0 RECOMMENDATIONS

Ground and surface water monitoring will continue at the TRONOX facility on a semiannual basis to assess the effects of remedial changes made at the site as required in the ROD. Field data results should be evaluated when sampling occurs to assess current with preceding site conditions.

The proposed arsenic RBC of 10 ug/l will require a method using a lower reporting limit. We recommend that arsenic analysis should be performed using EPA method 6020 (ICP/MS) for arsenic analysis with a reporting limit of 5 ug/l.

Parameters that fall below the RBC will be evaluated and reported to EPA when these occur. All sampling and analytical results should be reviewed semiannually in accordance with the protocols contained in SW846 and EPA laboratory data validation functional guidelines to assess the quality of the data results. Ground and surface water quality will be appended semiannually to the RD/RA database. Results of the data review will be transmitted to EPA and IDEQ.

All ground water quality trends and predicted water quality should be evaluated in an annual report to assess the improvements to ground and surface water quality. Future annual evaluations will include the incorporation of ground water monitoring data from the Evergreen facility. This facility monitors ground water downgradient of the Tronox property on industrial property owned by the City of Soda Springs. Evaluation of Evergreen data in conjunction with Tronox ground and surface water data will provide an increased understanding of ground water flow paths downgradient of the Tronox site.

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TABLES

TABLE 1-1
MONITOR WELL CONSTRUCTION DATA

Well Designation	Well Completion Date	Drilled Total Depth (T.D.) Below Grade (ft)	Boring Diameter (inches)	Steel Casing Depth Below Grade (ft)	PVC Casing Depth Below Grade (ft)	Screen Depth Below Grade (ft)	Sand Pack Interval Below Grade (ft)	Bentonite Interval Below Grade (ft)	Grout Seal Depth Below Grade (ft)
KM-1	10-07-91	56.5	8" 0 to T.D.	0 to 6.5	0 to 45.9	45.9 to 55.9	44.5 to 56.5	39.4 to 44.5	0 to 39.4
KM-2	09-21-91	57.8	8" 0 to T.D.	0 to 37.6	0 to 47.2	47.2 to 57.2	44.7 to 57.8	40.7 to 44.7	0 to 40.7
KM-3	10-11-91	49.5	8" 0 to T.D.	0 to 6.0	0 to 39.1	39.1 to 49.1	36.7 to 49.5	30.5 to 36.7	0 to 30.5
KM-4	10-02-91	54.5	8" 0 to T.D.	0 to 12.1	0 to 43.7	43.7 to 53.7	41.6 to 54.5	36.7 to 41.6	0 to 36.7
KM-5	10-01-91	49.3	8" 0 to T.D.	0 to 3.8	0 to 38.0	38.0 to 48.0	35.9 to 49.3	31.9 to 35.9	0 to 31.9
KM-6	09-24-91	45.3	8" 0 to T.D.	0 to 11.9	0 to 34.7	34.7 to 44.7	31.2 to 45.3	26.4 to 31.2	0 to 26.4
KM-7	09-26-91	56.8	8" 0 to T.D.	0 to 19.6	0 to 46.2	46.2 to 56.2	44.3 to 56.8	39.6 to 44.3	0 to 39.6
KM-8	10-21-91	46.0	8" 0 to T.D.	0 to 10.8	0 to 34.6	34.6 to 44.6	32.4 to 46.0	27.8 to 32.4	0 to 27.8
KM-9	09-29-91	58.3	8" 0 to T.D.	0 to 21.0	0 to 47.5	47.5 to 57.5	45.5 to 58.3	39.3 to 45.5	0 to 39.3
KM-10	10-12-91	121.0	10" 0 to 67 ft 8" 67 to T.D.	0 to 57.0	0 to 100.0	100.0 to 120.0	93.6 to 121.0	88.4 to 93.6	0 to 88.4
KM-11	10-29-91	105.0	10" 0 to T.D.	0 to 18.7	0 to 80.0	80.0 to 100.0	78 to 105.0	73 to 78	0 to 73
KM-12	10-29-91	155.0	8" 0 to T.D.	0 to 7.1	0 to 134.1	134.1 to 154.1	127 to 155.0	121 to 127	0 to 121
KM-13	10-07-91	57.0	8" 0 to T.D.	0 to 22.5	0 to 46.4	46.4 to 56.4	44.3 to 57.0	37.6 to 44.3	0 to 37.6
KM-15	09-24-92	58	10" 0 to T.D.	0 to 5.0	0 to 45.2	45.2 to 55.2	42.8 to 57.0	36.5 to 42.8	0 to 36.5

TABLE 1-1
MONITOR WELL CONSTRUCTION DATA

Well Designation	Well Completion Date	Drilled Total Depth (T.D.) Below Grade (ft)	Boring Diameter (inches)	Steel Casing Depth Below Grade (ft)	PVC Casing Depth Below Grade (ft)	Screen Depth Below Grade (ft)	Sand Pack Interval Below Grade (ft)	Bentonite Interval Below Grade (ft)	Grout Seal Depth Below Grade (ft)
KM-16	09-18-92	74.6	10" 0 to 5 ft 8" 5 to T.D.	0 to 5.0	0 to 63.3	63.3 to 73.3	60.8 to 74.6	56.0 to 60.8	0 to 56.0
KM-17	09-25-92	49.1	10" 0 to 5 ft 8" 5 to T.D.	0 to 5.0	0 to 38.2	38.2 to 48.2	36.3 to 49.1	30.9 to 36.3	0 to 30.9
KM-18	10-03-92	180	10" 0 to T.D.	0 to 5.0	0 to 152.6	152.6 to 172.6	150 to 173	145 to 150	0 to 145
KM-19	10-15-92	218	12" 0 to 8 ft 10" 8 to 167 ft 8" 167 to T.D.	0 to 57	0 to 193.6	193.6 to 213.6	190.9 to 214	182.9 to 190.9	0 to 182.9
MW-1	6-63	51.3	NA	NA	NA	NA	NA	NA	NA
MW-2[a]	6-63	42.4	NA	NA	NA	NA	NA	NA	NA
MW-3[a]	6-63	42.5	NA	NA	NA	NA	NA	NA	NA
MW-4	6-69	47	NA	NA	NA	37-47	20-47	NA	NA
MW-5	12-72	65	NA	NA	NA	NA	NA	NA	NA
MW-6	12-72	55.2	NA	NA	NA	NA	NA	NA	NA
MW-7	12-72	58	NA	NA	NA	48-58	20-58	NA	NA
MW-8	9-81	76	NA	NA	NA	26-76	20-76	NA	NA
MW-9	9-81	68	NA	NA	NA	28-68	17.5-68	NA	NA

[a] Well abandoned during Phase I.
NA Not Available

14626-019-031

TABLE 1-2
MAXIMUM CONCENTRATIONS OF COC AND MOST CURRENT CONCENTRATIONS IN TRONOX WELLS AND OFF-SITE SPRINGS

Well Designation	Arsenic Concentrations		Manganese Concentrations		Molybdenum Concentrations		Total Petroleum Hydrocarbons Concentrations		Tributyl Phosphate Concentrations		Vanadium Concentrations	
	PROPOSED RBC = 10 ug/l		RBC = 180 ug/l		RBC = 180 ug/l		RBC = 0.73 mg/l		RBC = 180 ug/l		RBC = 260 ug/l	
	Largest (ug/l)	Most Current (ug/l)	Largest (ug/l)	Most Current (ug/l)	Largest (ug/l)	Most Current (ug/l)	Largest (mg/l)	Most Current (mg/l)	Largest (ug/l)	Most Current (ug/l)	Largest (ug/l)	Most Current (ug/l)
KM-2*	53	13	444	38	11800	1100	2.0	NA	7	NA	15500	5000
KM-3*	27	13	1680	560	44900	6400	1.8	NA	1400	NA	13200	2300
KM-4	63	10	1160	90	15300	2200	NA	NA	NA	NA	23300	6400
KM-5*	12.2	ND	399	7.1	1460	200	NA	NA	3	NA	15800	1300
KM-6	6.5	6.3	291	180	2140	1400	2.0	NA	110	NA	6630	4500
KM-7	6.9	ND	197	94	593	300	2.0	NA	NA	NA	3410	2100
KM-8*	170	90	8770	5000	165000	41000	9.5	1.5	4442	590	29000	18000
KM-9*	5	ND	113	6.6	1740	160	NA	NA	ND	NA	3590	410
KM-11*	2	ND	157	16	5600	300	0.42	NA	112	NA	492	10
KM-12*	23	ND	177	29	9290	470	0.39	NA	13	NA	5580	660
KM-13*	4	ND	131	7.7	6790	220	0.18	NA	12	NA	6420	520
KM-15	5.6	ND	543	54	6950	450	0.15	NA	484	NA	3840	940
KM-16	7.3	ND	364	110	2300	780	1.9	NA	180	NA	4250	2400
KM-17	1.5	ND	84	2.6	987	350	1.2	NA	170	NA	493	18
KM-18	3.7	ND	332	47	6340	410	1.3	NA	410	NA	2990	720
KM-19*	2	ND	32.3	ND	258	23	1.1	NA	4	NA	558	130
Big Spring	1.1	ND	1.8	ND	508	210	NA	NA	NA	NA	13.6	2.5
Finch Spring	2	ND	4.4	ND	663	190	0.22	NA	ND	NA	91.7	58
Upper Ledger	3.7	ND	2.6	2.6	22.4	ND	NA	NA	NA	NA	5.1	ND
Lower Ledger	4.2	ND	1.5	ND	54.1	ND	NA	NA	NA	NA	14.9	ND

Footnotes:
* = Point of Compliance Well
NA = Not Available – not sampled during May 2007
ND = Not Detected (less than IDL)
Shaded cells indicate exceedence of RBC

TABLE 3-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
KM-1 (shallow well paired with KM-10)	Lateral gradient background well	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, No organics	No	None	Background sampling not needed; relying on RBC performance standards at POC wells and no statistical background comparison
KM-2 (shallow well)	Active calcine tailing impoundment/former scrubber pond area	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; No organics	Point of compliance well, although not truly downgradient of calcine or former scrubber pond; monitor changes in ground water concentrations in conjunction with changes at active calcine impoundment area and scrubber pond closure
KM-3 (shallow well paired with KM-11)	Reclaimed scrubber pond	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3,4 total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Point of compliance well; monitor changes in ground concentrations water along southern boundary in conjunction with scrubber pond closure
KM-4 (shallow well)	Active calcine tailing impoundment area	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1, 3, total chromatographable organics Round 1	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Will provide monitoring of calcine impoundment following capping. Not a POC well

TABLE 3-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
KM-5 (shallow well)	Historic scrubber pond/historic MAP ponds, Boiler blowdown pond/downgradient of facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; No organics	Point of compliance well, monitors downgradient of northern and central areas of entire plant facility; no active or historic activities downgradient of this location
KM-6 (shallow well)	Historic limestone Settling ponds	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Rounds 1, 3	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Monitors zone of increased transmissivity on the southern boundary of facility; not a POC well
KM-7 (shallow well)	Historic calcine impoundment area	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	No	None	Yes (2000-->)	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Monitors central portion of the facility and provides additional justification for contouring of COC; not a POC well
KM-8 (shallow well paired with KM-12 and KM-19)	Former S-X pond/ downgradient of plant facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, metals, radionuclides Rounds 1, 4, total chromatograph-able organics Round 1,3, TPH and semivols Rounds 4 and 8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP	Point of compliance well; monitor changes in ground water concentrations in conjunction with changes from S-X pond closure

TABLE 3-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
KM-9 (shallow well)	Former S-X pond/downgradient of plant facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; No organics	Point of compliance well, downgradient of entire facility; comparisons can be made with ground water model results to track and evaluate performance
KM-10 (intermediate well, paired with KM-1)	Intermediate depth background well	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	No	None	Background sampling not needed; relying on RBC performance standards at POC wells and no statistical background comparison
KM-11 (intermediate well, paired with KM-3)	Former scrubber pond	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Rounds 1,3, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; No organics	Point of compliance well; monitor changes in ground water concentrations in conjunction with scrubber pond closure
KM-12 (intermediate well paired with KM-8, KM-19)	Former S-X pond/ downgradient of plant facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Round 1, total chromatographable organics Round 1	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Point of compliance well; monitor changes in ground water concentrations in conjunction with changes from S-X pond closure
KM-13 (shallow well)	Former S-X pond (north end) and downgradient of plant facility	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, radio-nuclides Round 1, total chromatographable organics Round 1	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Point of compliance well, downgradient of entire facility

TABLE 3-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
KM-15 (shallow well, paired with KM-18)	Off-site well southwest of former S-X pond and within main area of impacted ground water	Not completed prior to Round 5	Long-list metals Round 5, short-list metals Rounds 6 through 8, semivols and TPH Rounds 5-8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Located in off-site area near modeled point; current RBC exceedences of , Mo, and V
KM-16 (shallow well)	Off-site well south of former S-X and settling ponds	Not completed prior to Round 5	Long-list metals Round 5, short-list metals Rounds 6 through 8, semivols and TPH Rounds 5-8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Located off-site and laterally downgradient of the site; RBC exceedences of Mo, and V
KM-17 (shallow well)	Off-site well southwest of former scrubber pond and active calcine tailing	Not completed prior to Round 5	Long-list metals Round 5, short-list metals Rounds 6 through 8, semivols and TPH Rounds 5-8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Located off-site and laterally downgradient of the site; RBC exceedences of Mo
KM-18 (intermediate well, paired with KM-15)	Off-site well southwest of former S-X pond, pond and within main area of impacted ground water, paired with KM-15	Not completed prior to Round 5	Long-list metals, semivols and TPH Rounds 5-8	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Monitors deeper aquifer zone for ground water impact; current RBC exceedences Mo, and V
KM-19 (deep well paired with KM-8 and KM-12)	Former S-X pond and downgradient of plant facility	Not completed prior to Round 5	Long-list metals Round 5, short-list metals Rounds 6 through 8, semivols and TPH Round 5	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP; no organics	Point of compliance well; monitor changes in ground water concentrations in conjunction with changes from S-X pond closure

TABLE 3-1

SAMPLING HISTORY AND SAMPLING RATIONALE FOR REMEDIAL DESIGN/ REMEDIAL ACTION GROUND WATER SAMPLING

Well/Sample Location	Source Area Monitored	Round 1 Through 8 Sample Events		Round 9 Through 12 Sample Events		RD/RA Sample Events And Low Flow Sampling		
		Sampled? (Yes/No)	Analytes	Sampled? (Yes/No)	Analytes	Sample Site? (Yes/No)	Analytes	Justification For Sampling/Not Sampling
Finch Spring (spring discharging from base of Finch Fault to surface water)	Spring south of facility which has appeared to be impacted primarily from scrubber discharge	Yes	Long-list metals Round 1-3, short-list metals Rounds 4 through 8, long-list metals, semivols and TPH Round 5	Yes	Metals, General Indicators	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Monitor downgradient changes to ground water from scrubber pond closure and other remedial actions on-site, current RBC exceedence of Mo
Big Spring (spring discharging to surface water flowing to Bear River)	Spring south of Soda Springs, furthest south discharge identified from Bear River Basin to Bear River	Not sampled prior to Round 6	Short-list metals	Yes	Metals, General Indicators, no organics	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Current exceedence of Mo RBC, too far from plant to measure direct changes associated with remedial actions; other influencing factor contributing to ground water upgradient of site and downgradient of Trononx, will continue to monitor
Upper Ledge(r) Spring (spring discharging from Ledger Creek drainage, between Kelley Park and Rabbit Mountain	An important source of drinking water for the town of Soda Springs. EPA requested additional monitoring of this spring by KMC LLC following public meeting and on amended ROD comments in June 2000.	1 Event (no impacts noted)	Long-list metals Round 1	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Monitor ground water quality
Lower Ledge(r) Spring (spring discharging from Ledger Creek drainage, between Kelley Park and Rabbit Mountain	An important source of drinking water for the town of Soda Springs. EPA requested additional monitoring of this spring by KMC LLC following public meeting and on amended ROD comments in June 2000.	1 Event (no impacts noted)	Long-list metals Round 1	No	None	Yes	Table 4-3 of RD/RA GW SAP and QAPP, no organics	Monitor ground water quality

TABLE 5-1
CHRONOLOGY OF PROCESS CHANGES

Event	Date(s)	Comments
S-X stream diverted from the S-X pond to the scrubber pond	1992 through 1993	Flow may have been diverted between ponds during this time period.
MAP ponds taken out of service; third roaster taken off-line in April	1993	Ponds reclaimed. Effects of remediation apparent in well KM-5.
S-X pond receiving discharge from S-X circuit	1994	S-X circuit discharge diverted to S-X pond for last time.
S-X stream diverted from the S-X pond to the scrubber pond	Late 1994 to mid 1995	S-X pond contained residual process water during 1995
S-X stream diverted to newly-constructed lined ponds	Mid 1995	Precipitation continued to fill the S-X pond basin and infiltrate. Pond contained significant volume of precipitation during 1996-1997 winter.
Scrubber pond taken out of service	April 1997	Scrubber pond pumped to the calcine pond. Some scrubber stream sent to calcine ponds. Residual liquid in pond and meteoric water drained out during stabilization of the pond sediments. All baghouses on-line in October.
Discontinue sluicing calcine	April – October 1997	Calcine dewatered, and residual water recycled in process. Dewatered calcine stockpiled north of the calcine impoundment.
Fertilizer Plant Operational	July 1998 to May 2000	Calcine removed from active calcine Impoundment, processed to fertilizer. Reject fertilizer placed in calcine impoundment.
Discontinue Vanadium Processing – Vanadium Plant Idle	January 1999 to present	Discontinue stockpiling of calcine, discontinue all vanadium process streams to lined ponds, discontinue the recycle of roaster reject.
Cap Active Calcine Impoundment	May 2001 through August 2001	Calcine was capped using multi-component cover to eliminate meteoric infiltration through calcine tailing. Substantial amount of dust control/construction water used.
Dismantle Vanadium Plant	November 2001 through May 2002	Materials removed to approved facility, surface footprint cleaned in preparation for surface regrade. Footprint regraded with limestone fines in April/May 2003
Dismantle Fertilizer Plant	November 2002 through June 2003	Materials removed to approved facility, surface footprint cleaned in preparation for surface regrade.
Reclaim Stormwater Runoff Ponds	September through October 2003	Solids and liquids removed to 10-acre pond, site regraded and reclaimed.
Reclaim 5-Acre Ponds	September through October 2004	Solids and liquids removed to 10-acre pond, east pond site regraded and reclaimed.
Regrade Scrubber Pond Cover	November 2005	Fill and regrade south of calcine cap

Note: Changes in the discharge locations of both the S-X and scrubber streams affected concentrations in both on-site and off-site wells and Finch Spring during operation.

TABLE 6-1
SUMMARY OF PROJECTED COC TRENDS

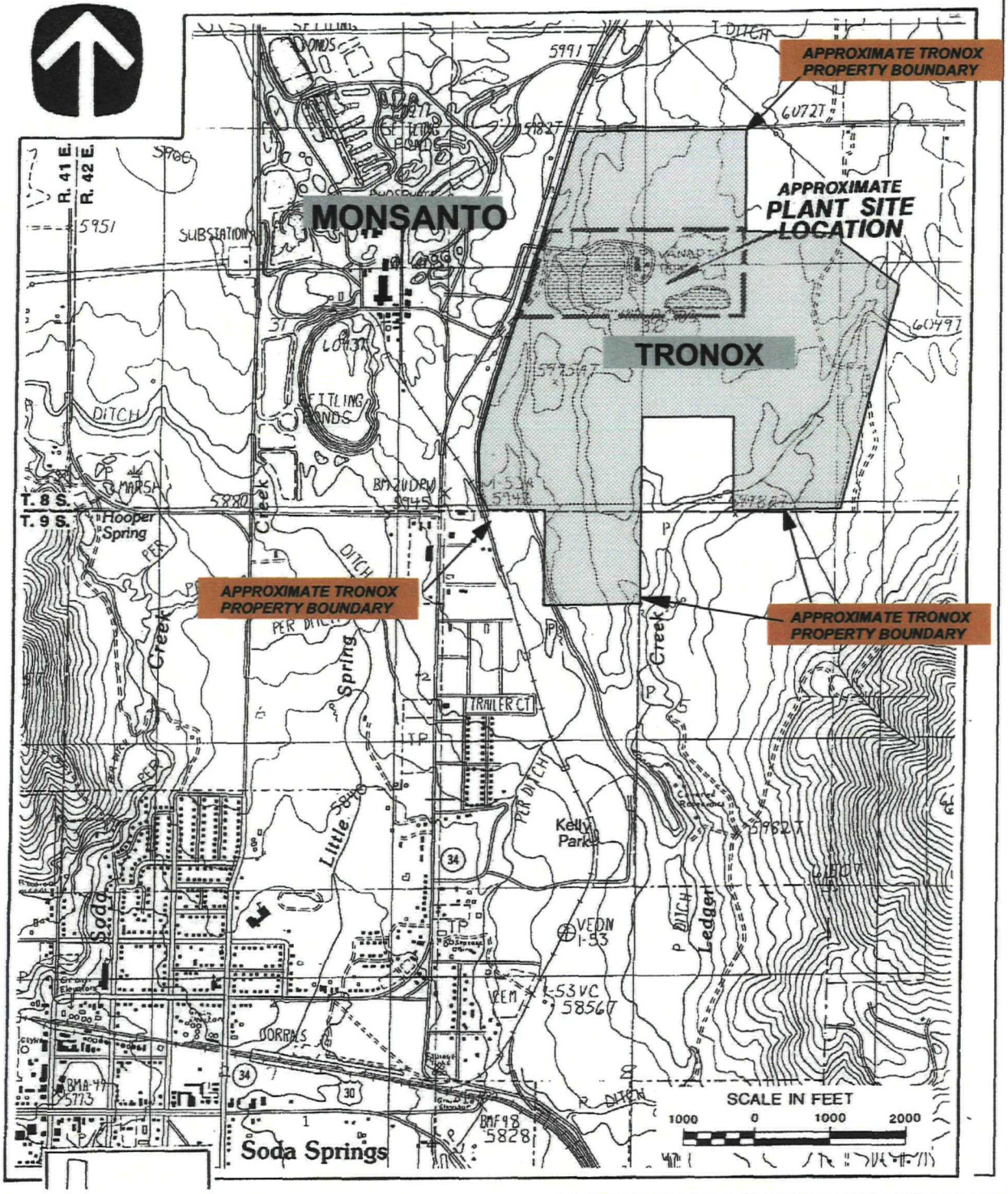
Well Designation	Manganese Concentrations		Molybdenum Concentrations		Vanadium Concentrations	
	RBC = 180 ug/l		RBC = 180 ug/l		RBC = 260 ug/l	
	Most Current (ug/l)	Projected Year Below RBC	Most Current (ug/l)	Projected Year Below RBC	Most Current (ug/l)	Projected Year Below RBC
KM-2*	38	NE	1100	>2015	5000	>2015
KM-3*	560	NE	6400	>2015	2300	>2015
KM-4	90	NE	2200	NE	6400	NE
KM-5*	7.1	NE	200	2008	1300	2014
KM-6	180	NE	1400	>2015	4500	>2015
KM-7	94	NE	300	NE	2100	NE
KM-8*	5000	>2020	41000	>2020	18000	ND
KM-9*	6.6	NE	160	2003	410	2009
KM-11*	16	NE	300	NE	10	NE
KM-12*	29	NE	470	2013	660	2018
KM-13*	7.7	NE	220	2008	520	2011
KM-15	54	NE	450	2009	940	2018
KM-16	110	NE	780	2020	2400	>2020
KM-17	2.6	NE	350	2015	18	NE
KM-18	47	NE	410	2009	720	2015
KM-19*	ND	NE	23	NE	130	NE

Shaded Numbers Indicate Exceedence of RBC

Footnotes:

* = Point of Compliance Well
NE = Well not used for COC projection trend
ND = Can not assess trend based on current monitoring data following LSE

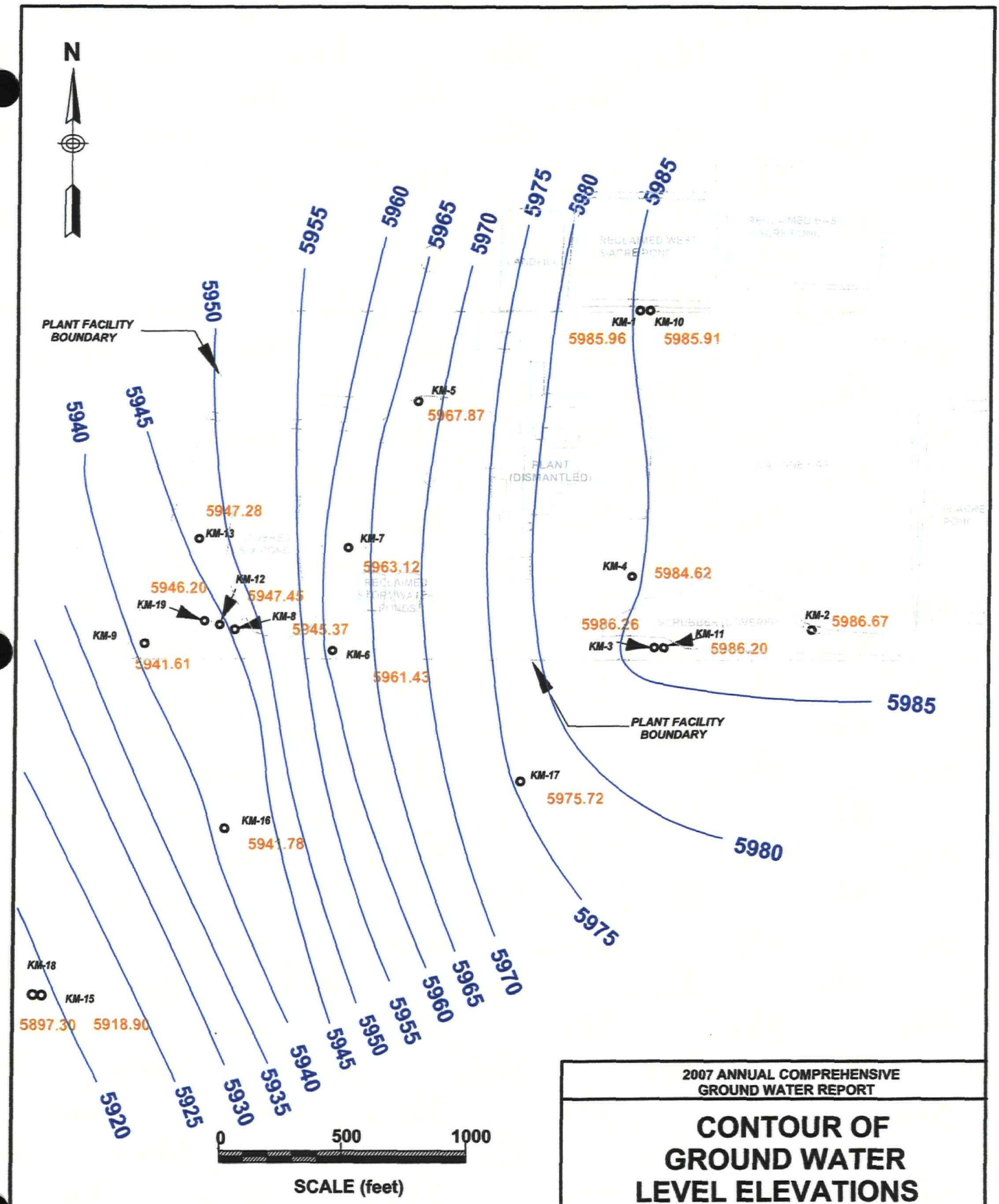
FIGURES



REFERENCE: U.S.G.S. QUADRANGLE SODA SPRINGS, IDAHO PROVISIONAL EDITION 1982.

APPROXIMATE TRONOX PROPERTY BOUNDARY LOCATION MAP

FIGURE 1-1



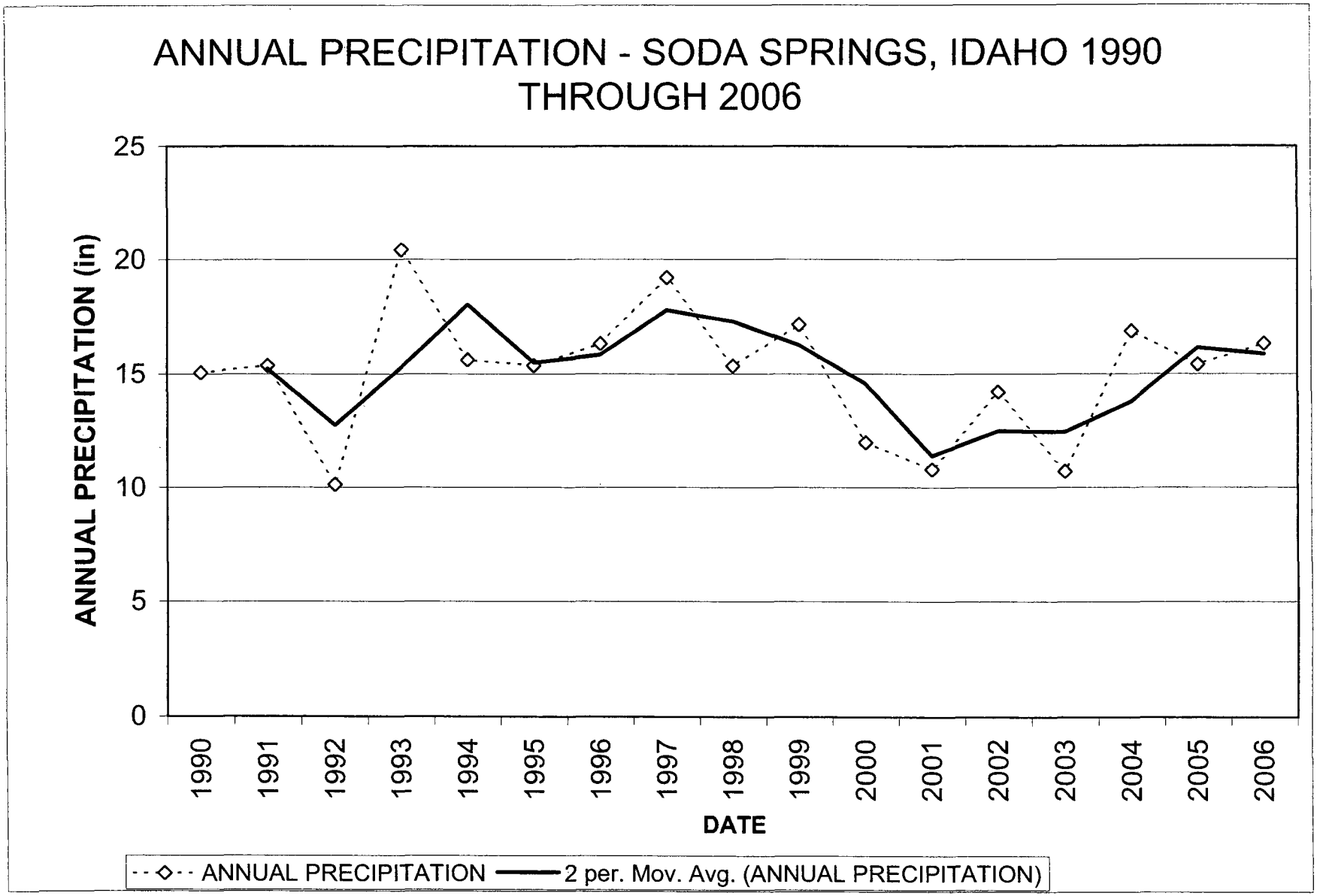
NOTE: CONTOURS BASED ON GROUND WATER LEVELS IN SHALLOW WELLS

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

CONTOUR OF GROUND WATER LEVEL ELEVATIONS MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 1-2


ANNUAL PRECIPITATION - SODA SPRINGS, IDAHO 1990 THROUGH 2006
ANNUAL PRECIPITATION (in)
25
20
15
10
5
0
1990
1991
1992
1993
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1996
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1998
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2004
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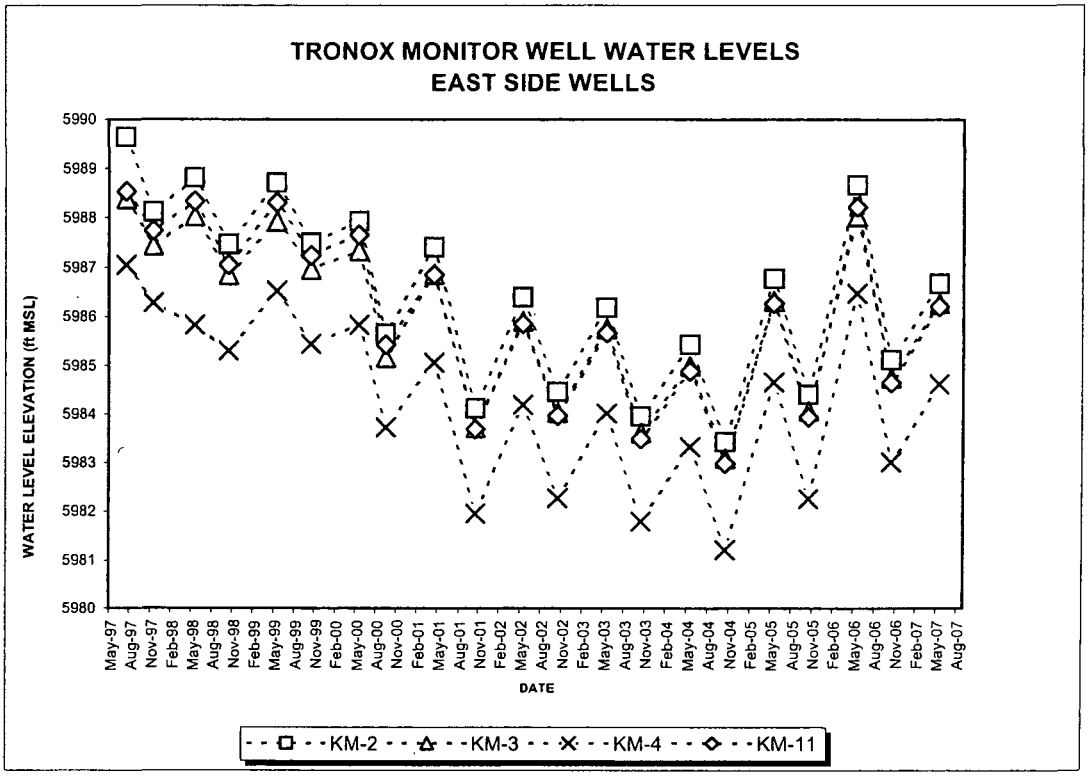
2006
DATE
ANNUAL PRECIPITATION
2 per. Mov. Avg. (ANNUAL PRECIPITATION)

WATER LEVELS VERSUS TIME
TRONOX ON-SITE WELLS
FOLLOWING LSE AND POND RECLAMATION



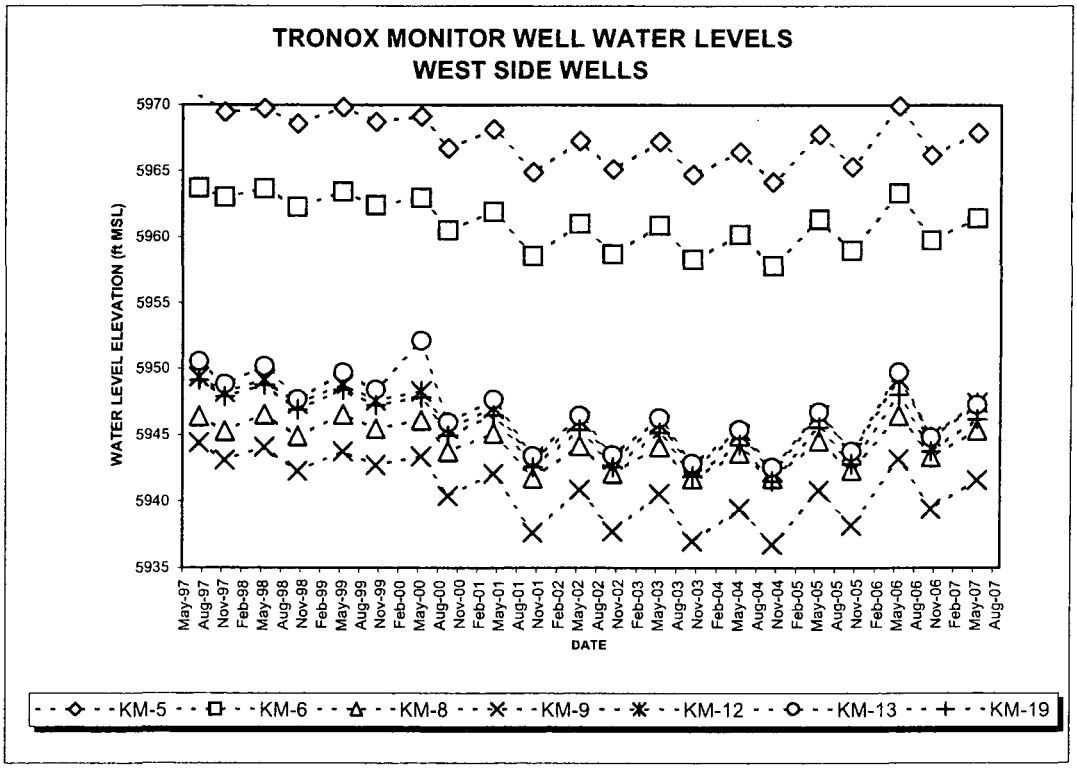
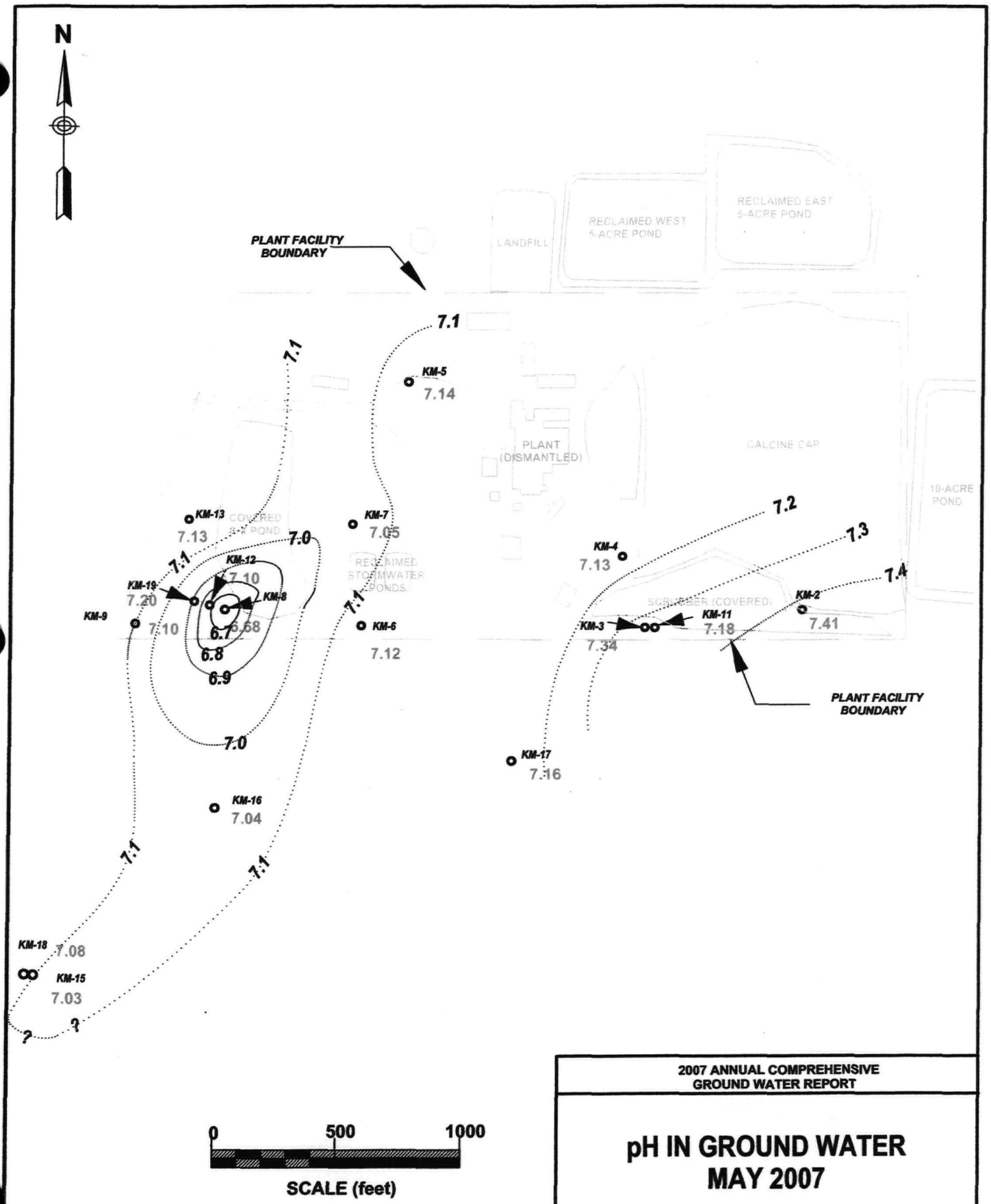


FIGURE 1-4



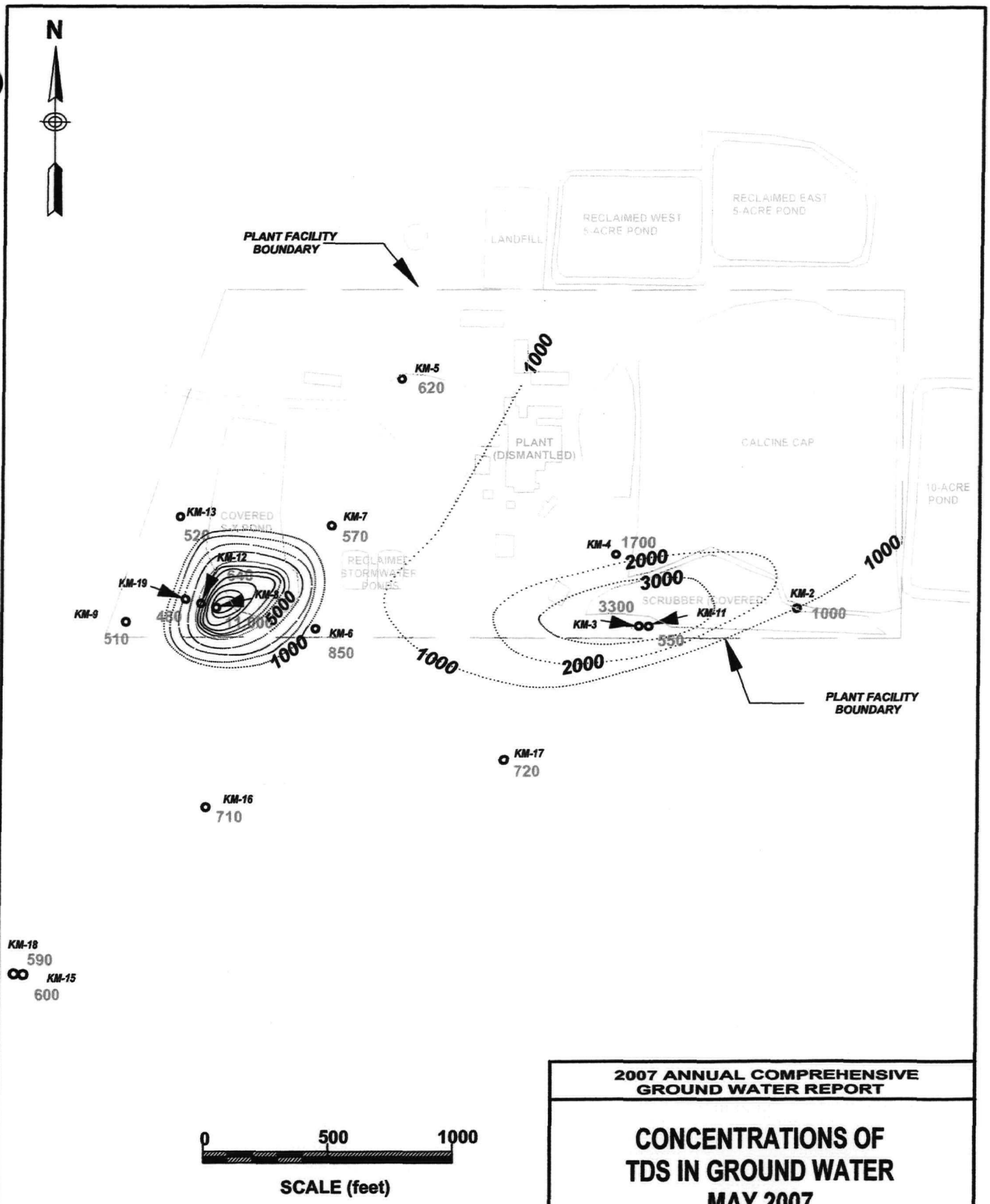
NOTE: CONCENTRATIONS ARE IN pH units.
CONCENTRATIONS BASED ON OBSERVED CONCENTRATIONS IN SHALLOW AQUIFER.

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

pH IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 4-1



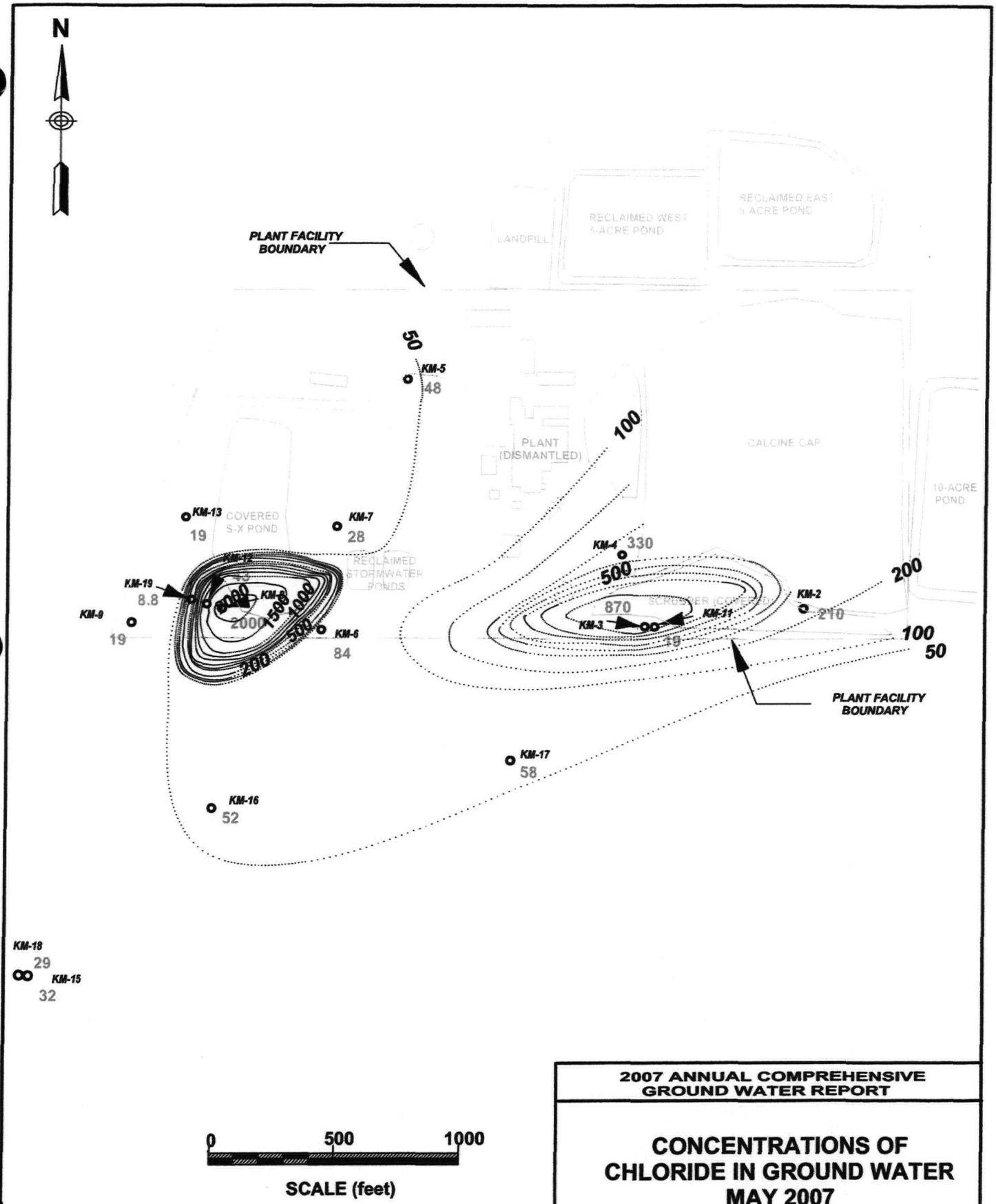
NOTE: CONCENTRATIONS ARE IN mg/l.
CONTOURS BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

CONCENTRATIONS OF TDS IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 4-2



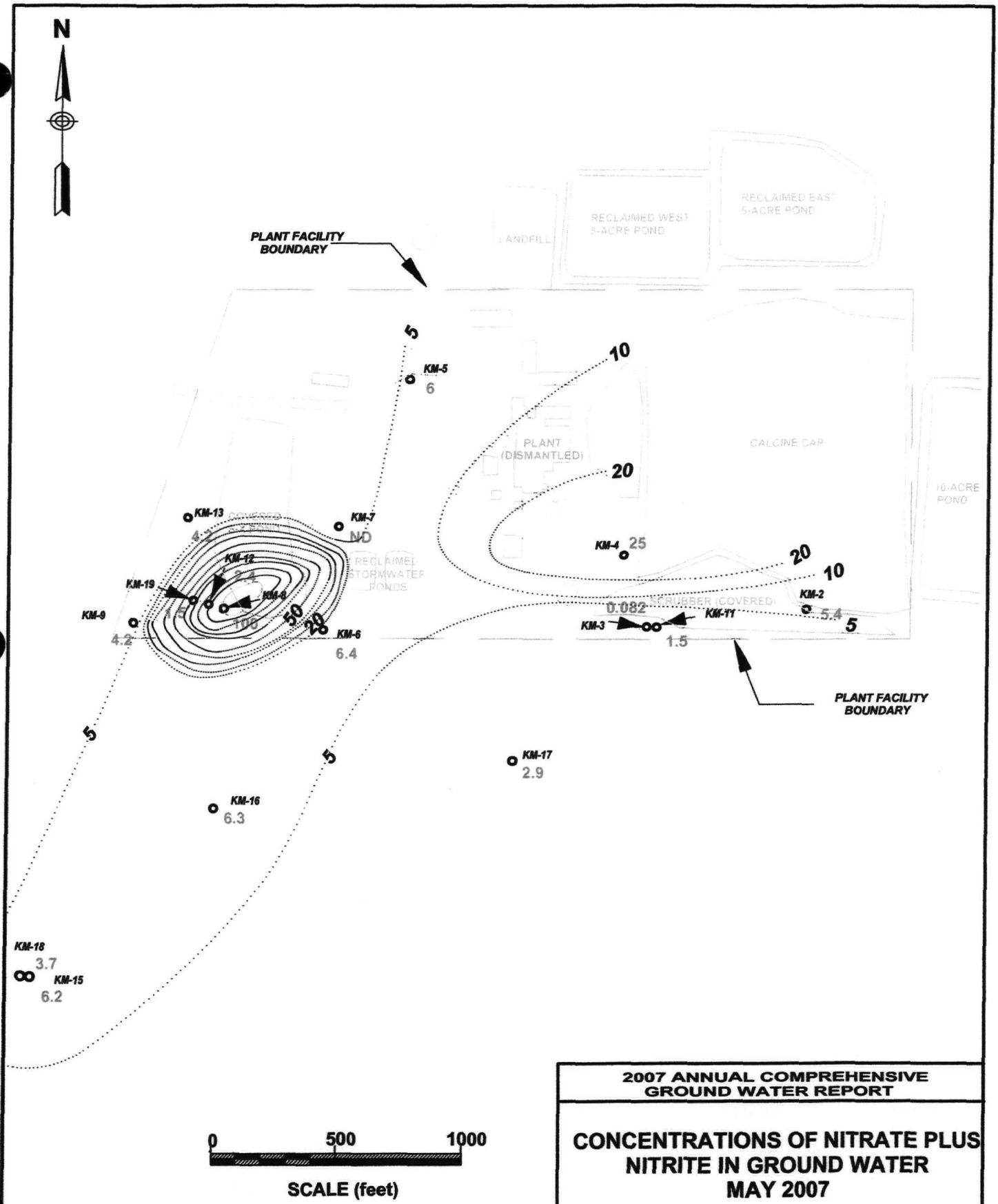
NOTE: CONCENTRATIONS ARE IN mg/l.
CONTOURS BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

CONCENTRATIONS OF CHLORIDE IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 4-3



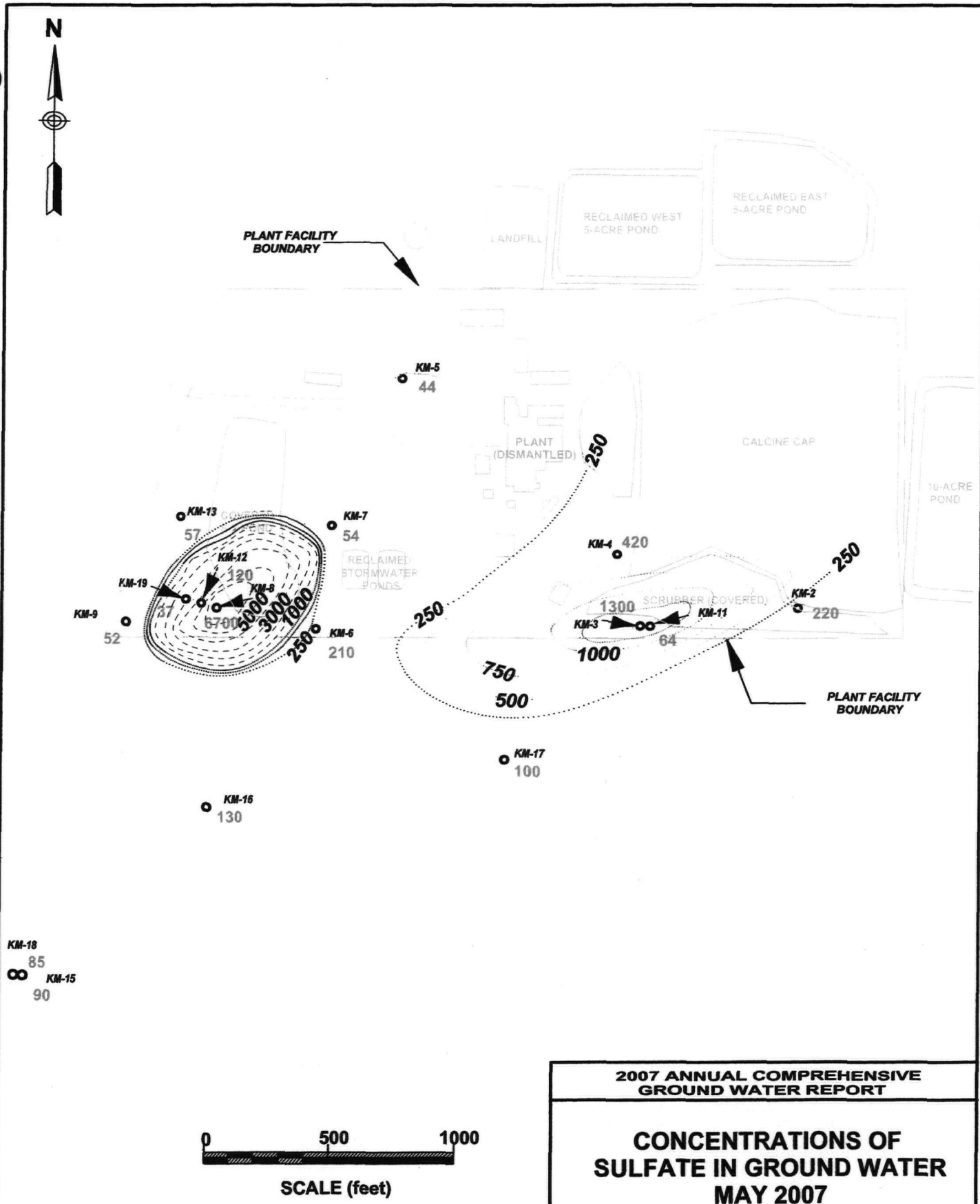
NOTE: CONCENTRATIONS ARE IN mg/l.
CONTOURS BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

CONCENTRATIONS OF NITRATE PLUS NITRITE IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 4-4



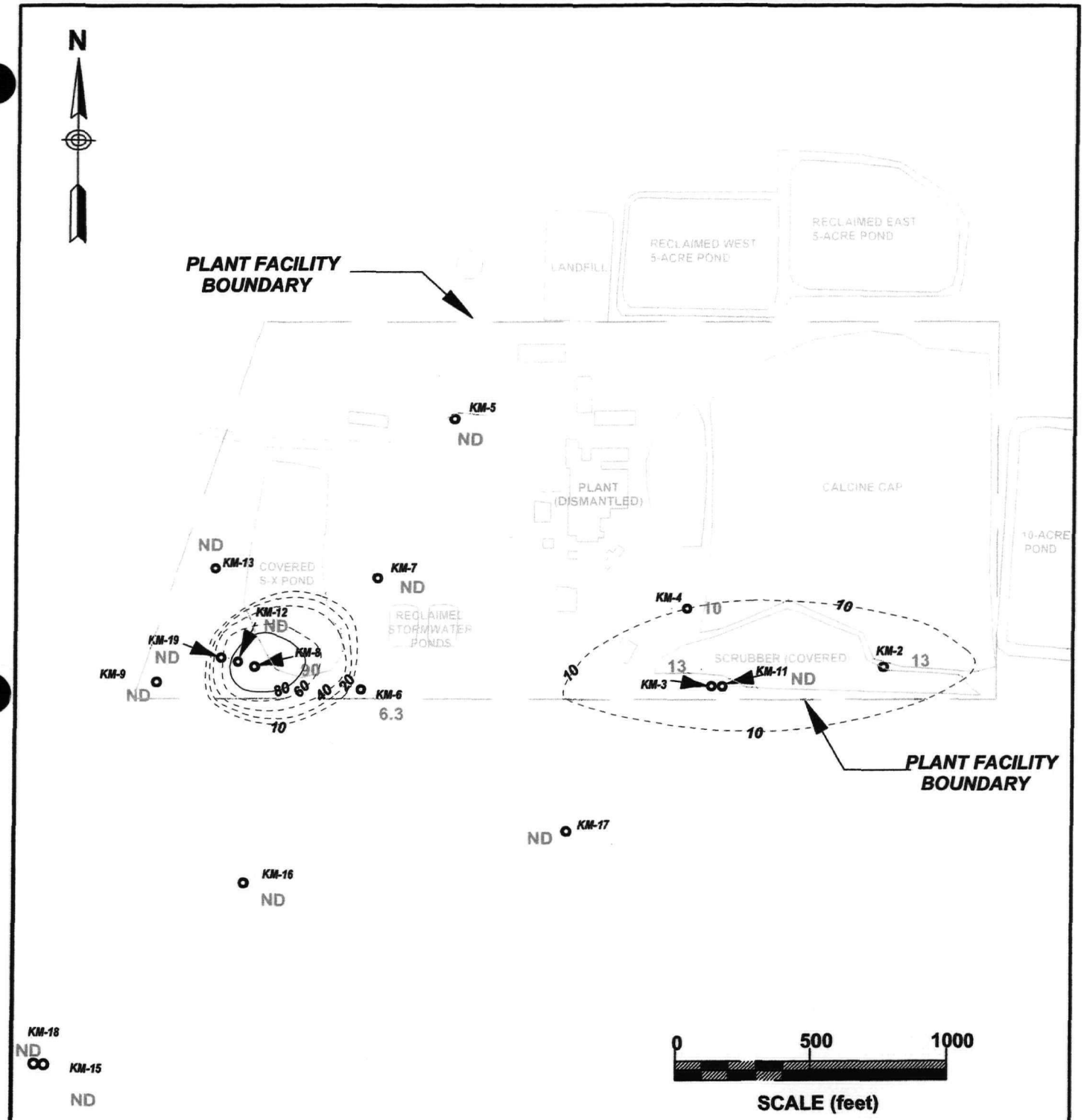
NOTE: CONCENTRATIONS ARE IN mg/l.
CONTOURS BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

CONCENTRATIONS OF SULFATE IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 4-5



NOTE: CONCENTRATIONS ARE IN ug/l. CONTOURS BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

PROPOSED RBC FOR ARSENIC IS 10 ug/l

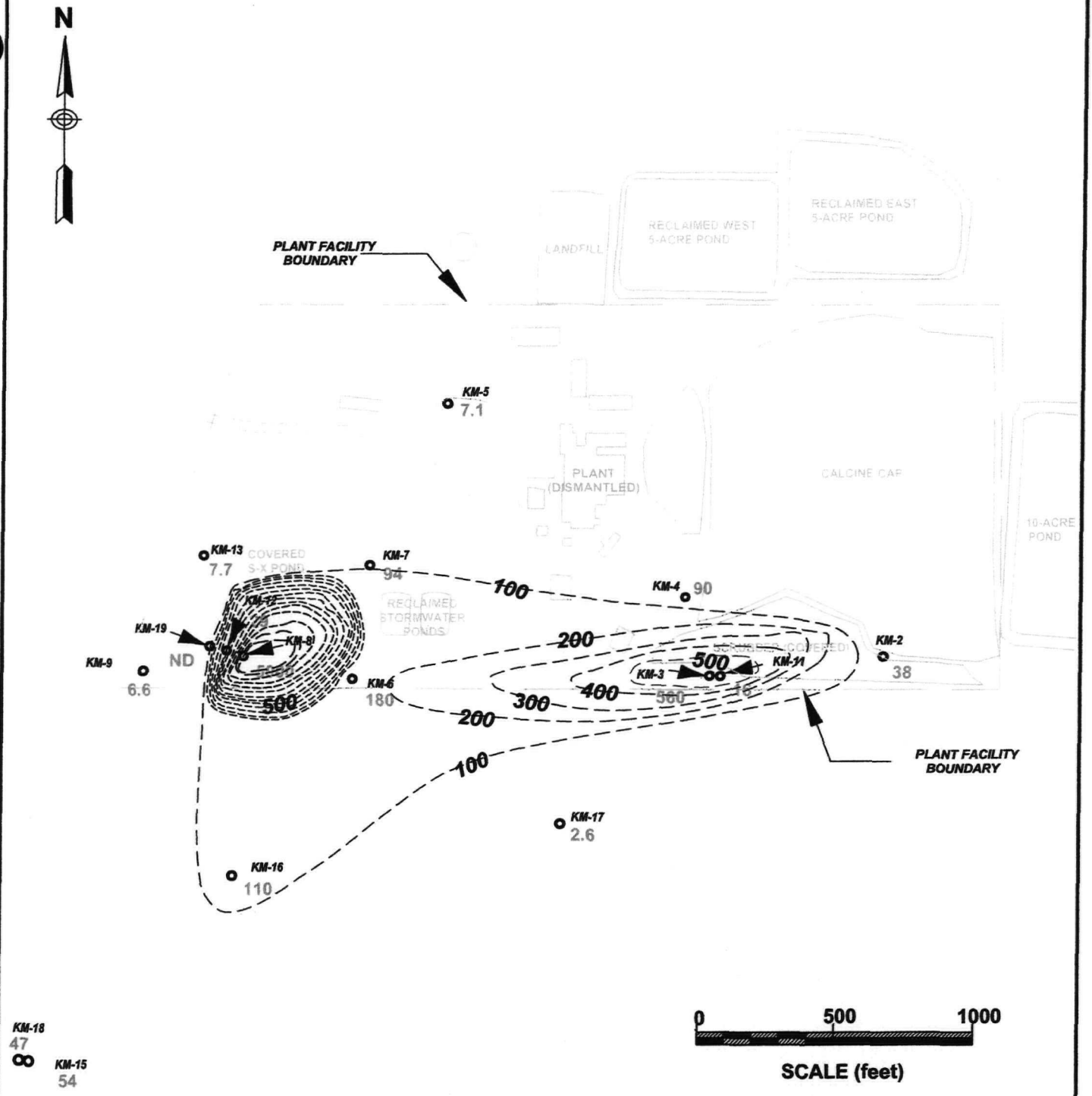
NOTE: CONCENTRATIONS LESS THAN THE METHOD DETECTION LIMIT OF 15 ug/l ARE FLAGGED AS ESTIMATED

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

CONCENTRATIONS OF ARSENIC IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 4-6



NOTE: CONCENTRATIONS ARE IN ug/l. CONTOURS BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.

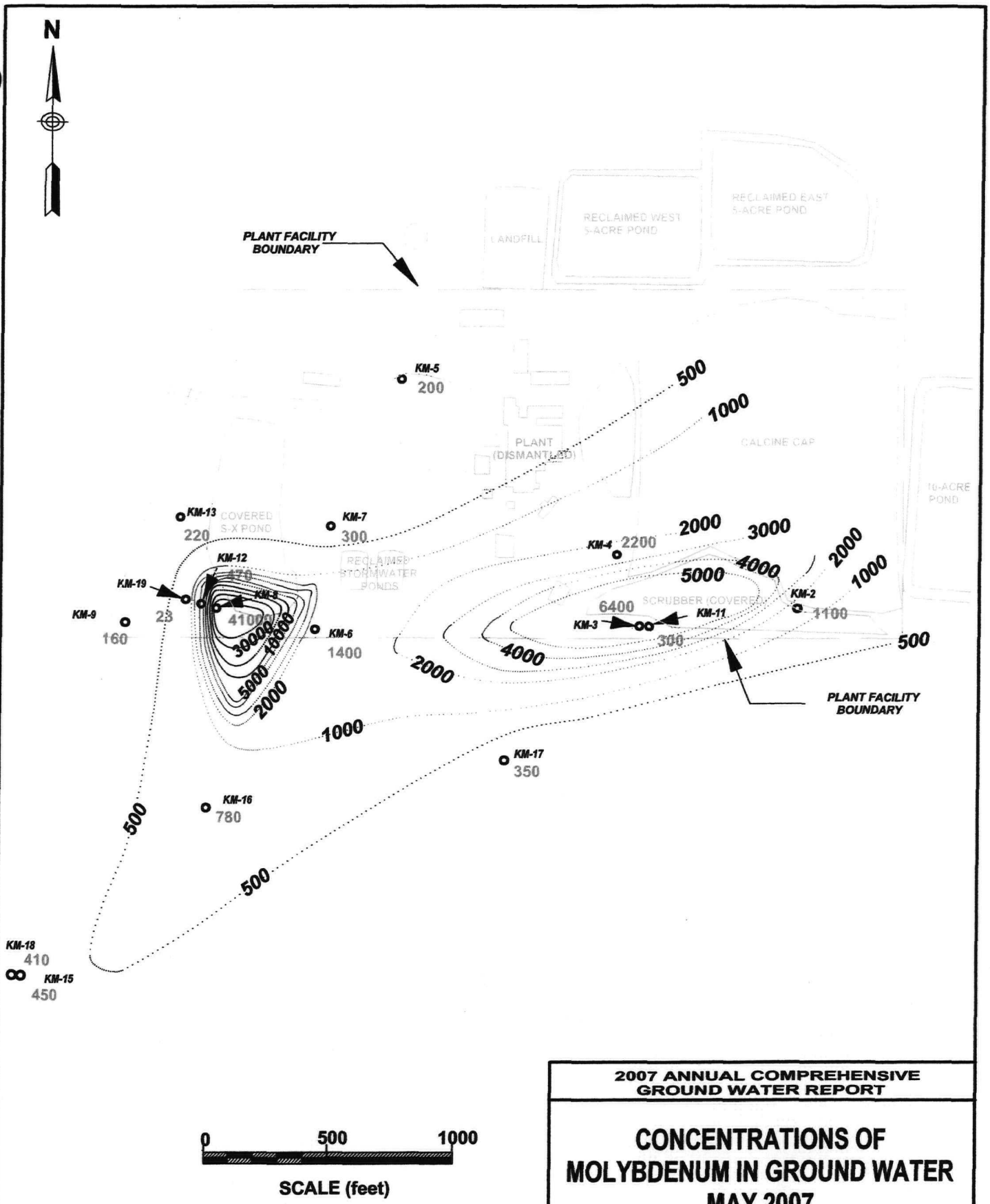
RBC FOR MANGANESE IS 180 ug/l

2006 ANNUAL COMPREHENSIVE GROUND WATER REPORT

CONCENTRATIONS OF MANGANESE IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 4-7



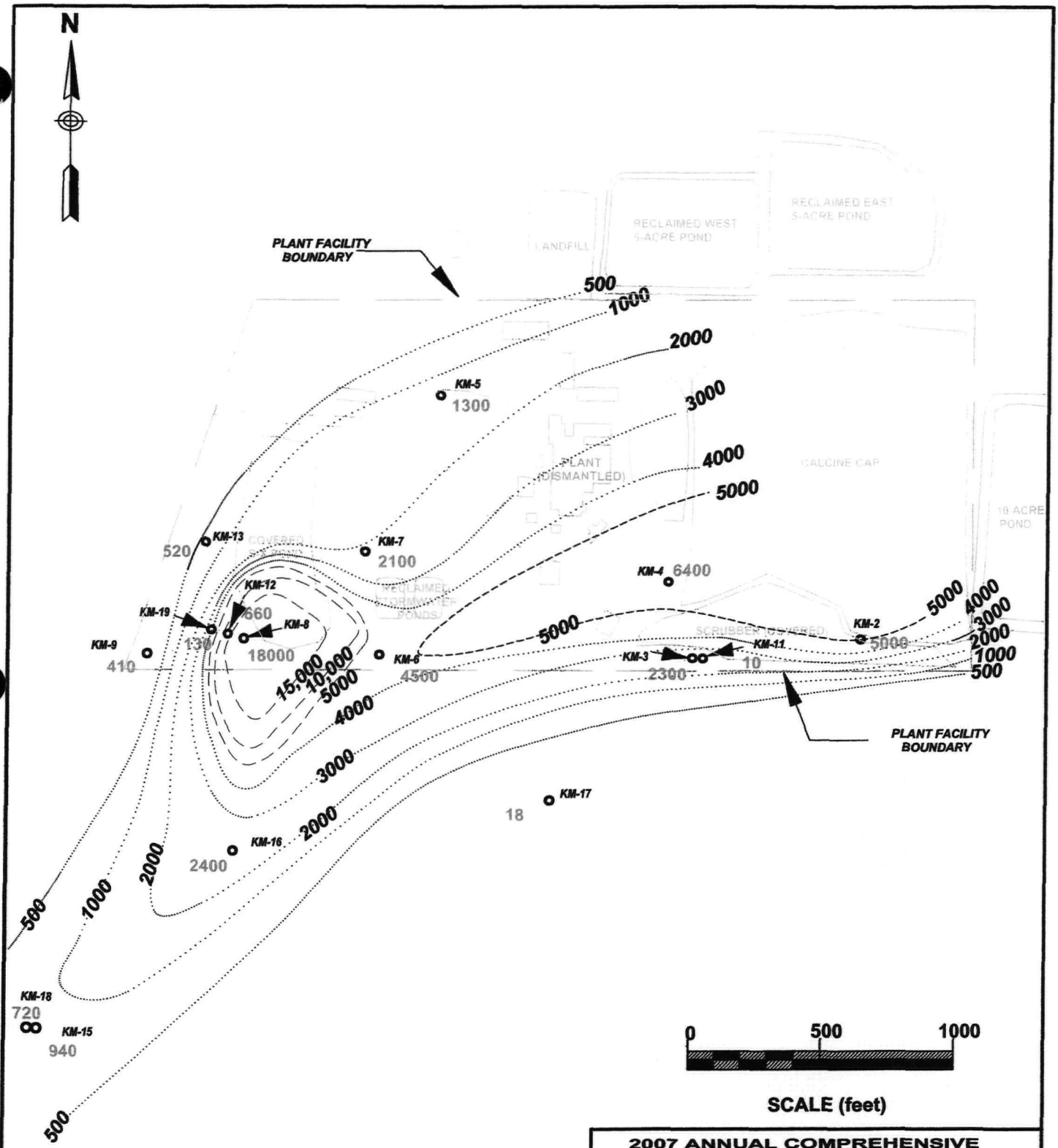
NOTE: CONCENTRATIONS ARE IN ug/l.
CONTOURS BASED ON CONCENTRATIONS IN SHALLOW AQUIFER.
RBC FOR MOLYBDENUM IS 180 ug/l.

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

CONCENTRATIONS OF MOLYBDENUM IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

FIGURE 4-8



NOTE: CONCENTRATIONS ARE IN ug/l.
CONCENTRATIONS BASED ON OBSERVED CONCENTRATIONS IN SHALLOW AQUIFER.

RBC FOR VANADIUM IS 260 ug/l .

2007 ANNUAL COMPREHENSIVE GROUND WATER REPORT

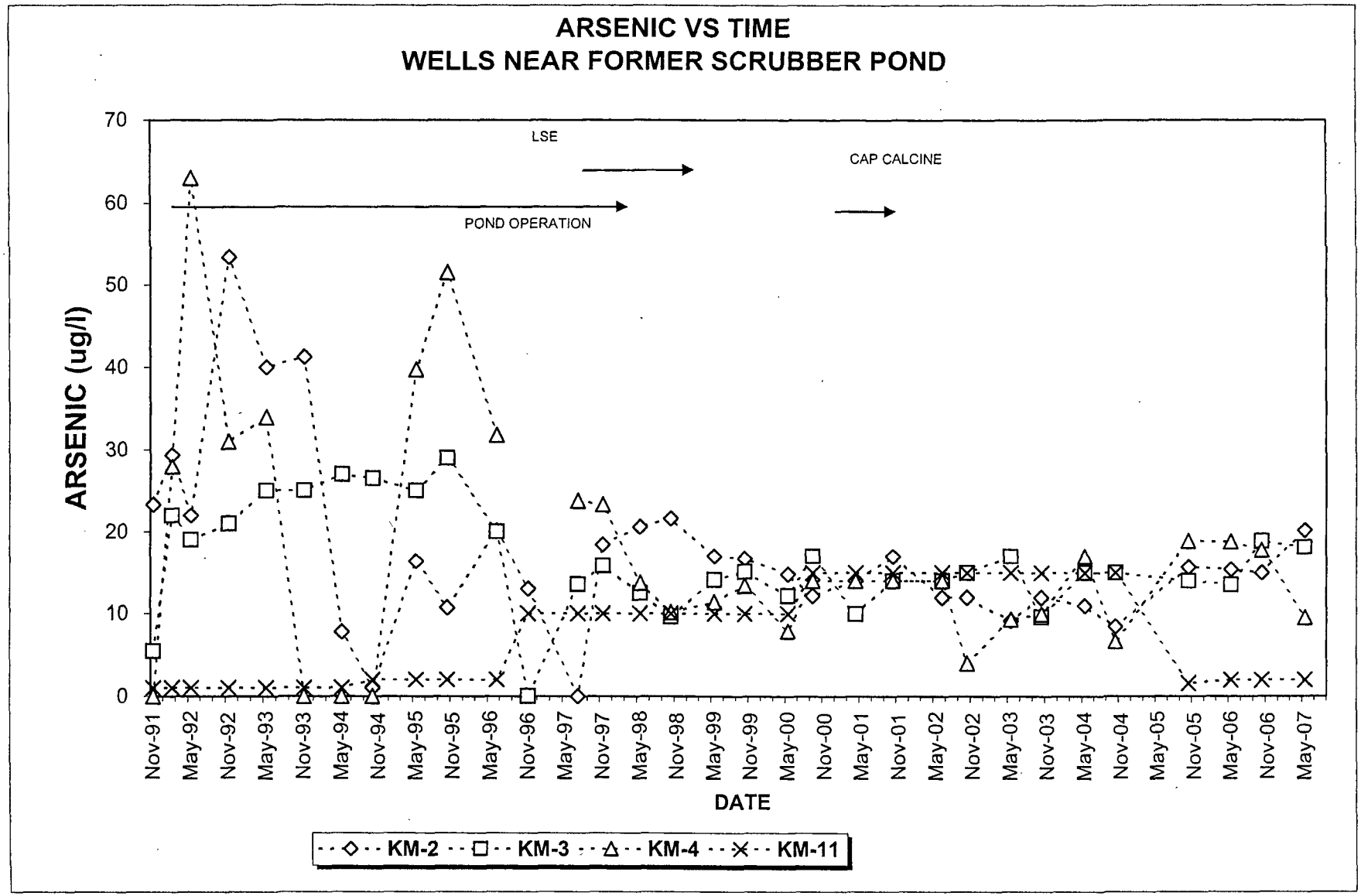
CONCENTRATIONS OF VANADIUM IN GROUND WATER MAY 2007

TRONOX
SODA SPRINGS, IDAHO

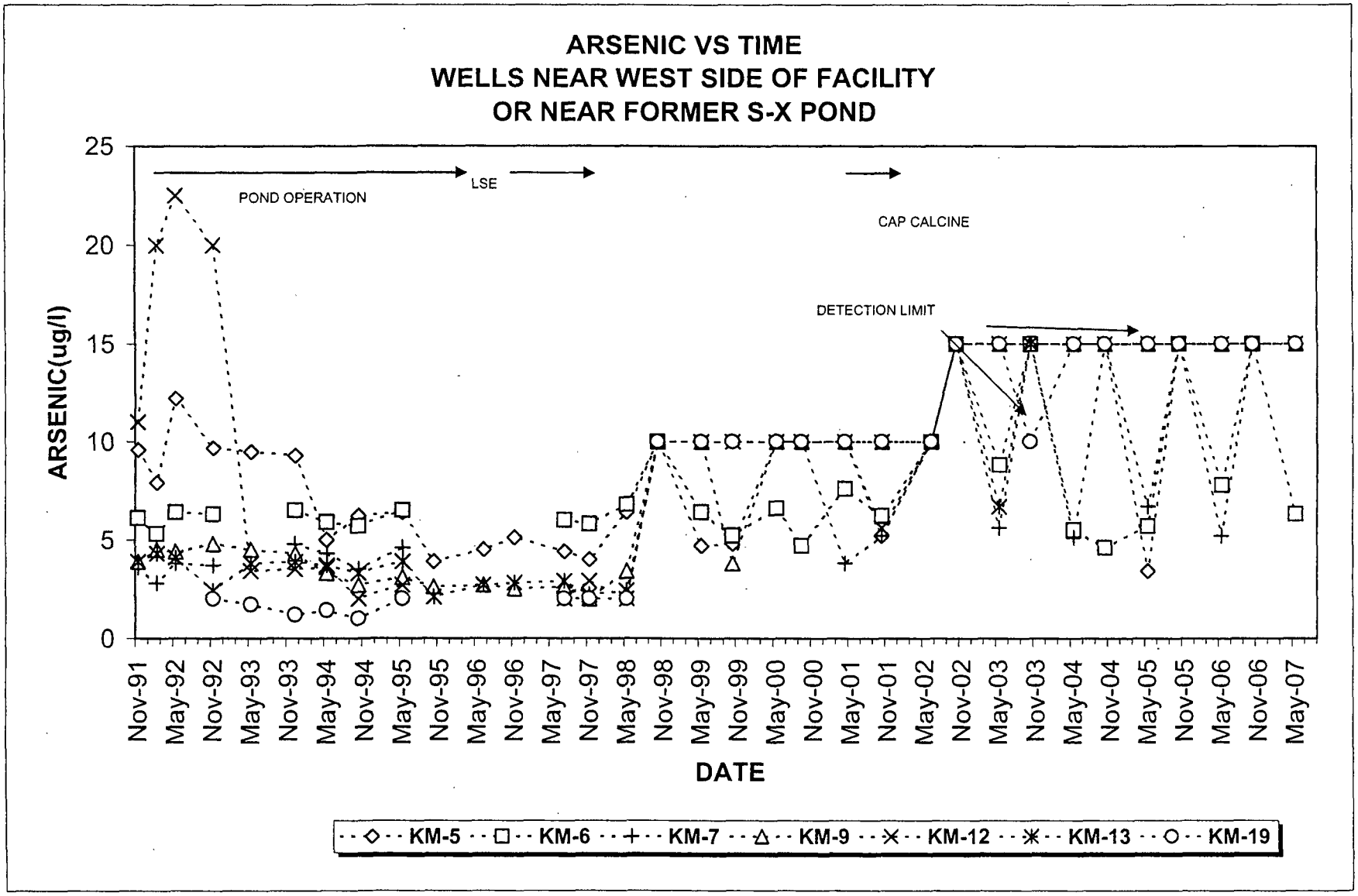
FIGURE 4-9

APPENDIX A

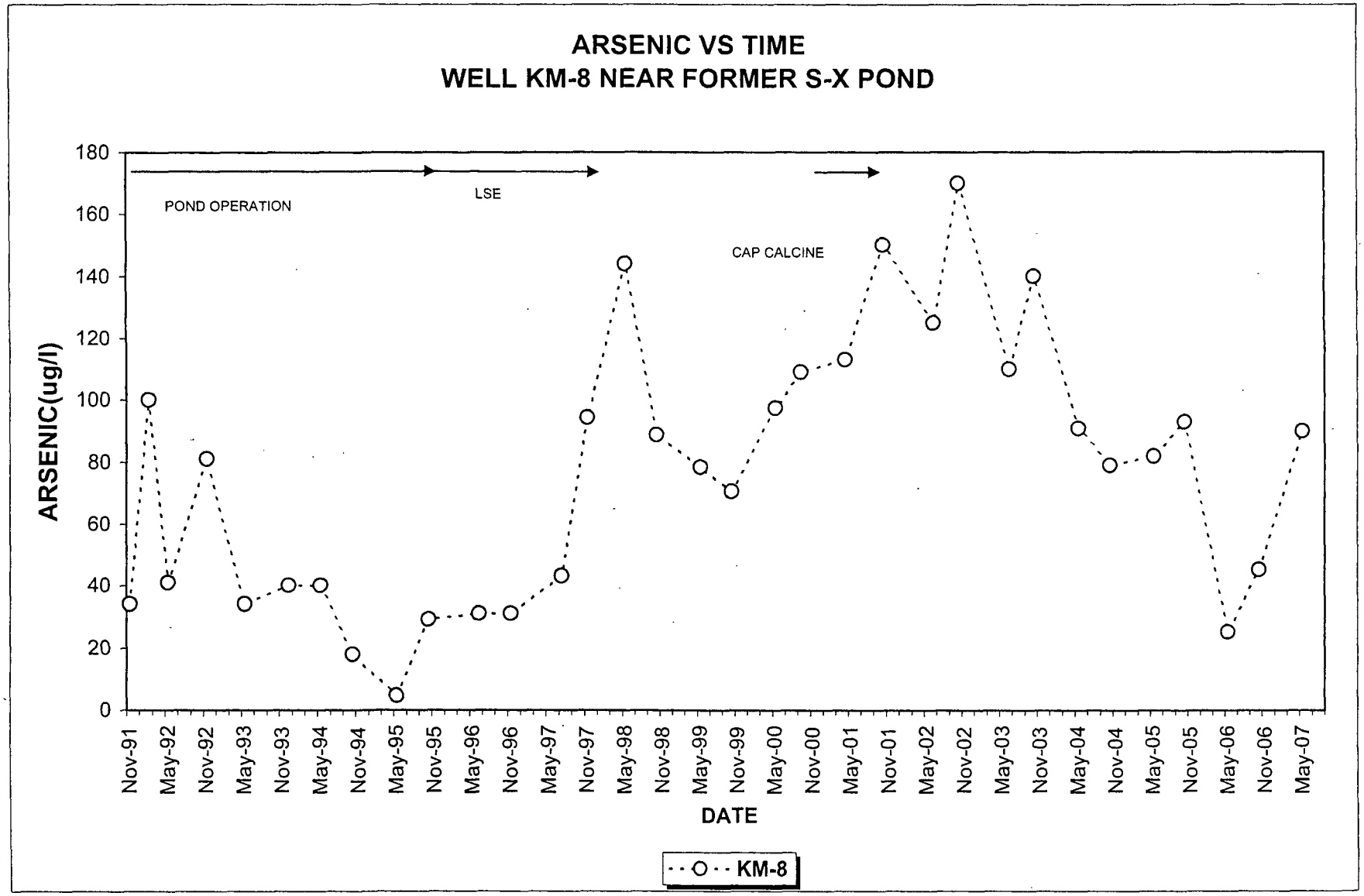
GRAPHS OF GROUND AND SURFACE WATER QUALITY VERSUS TIME



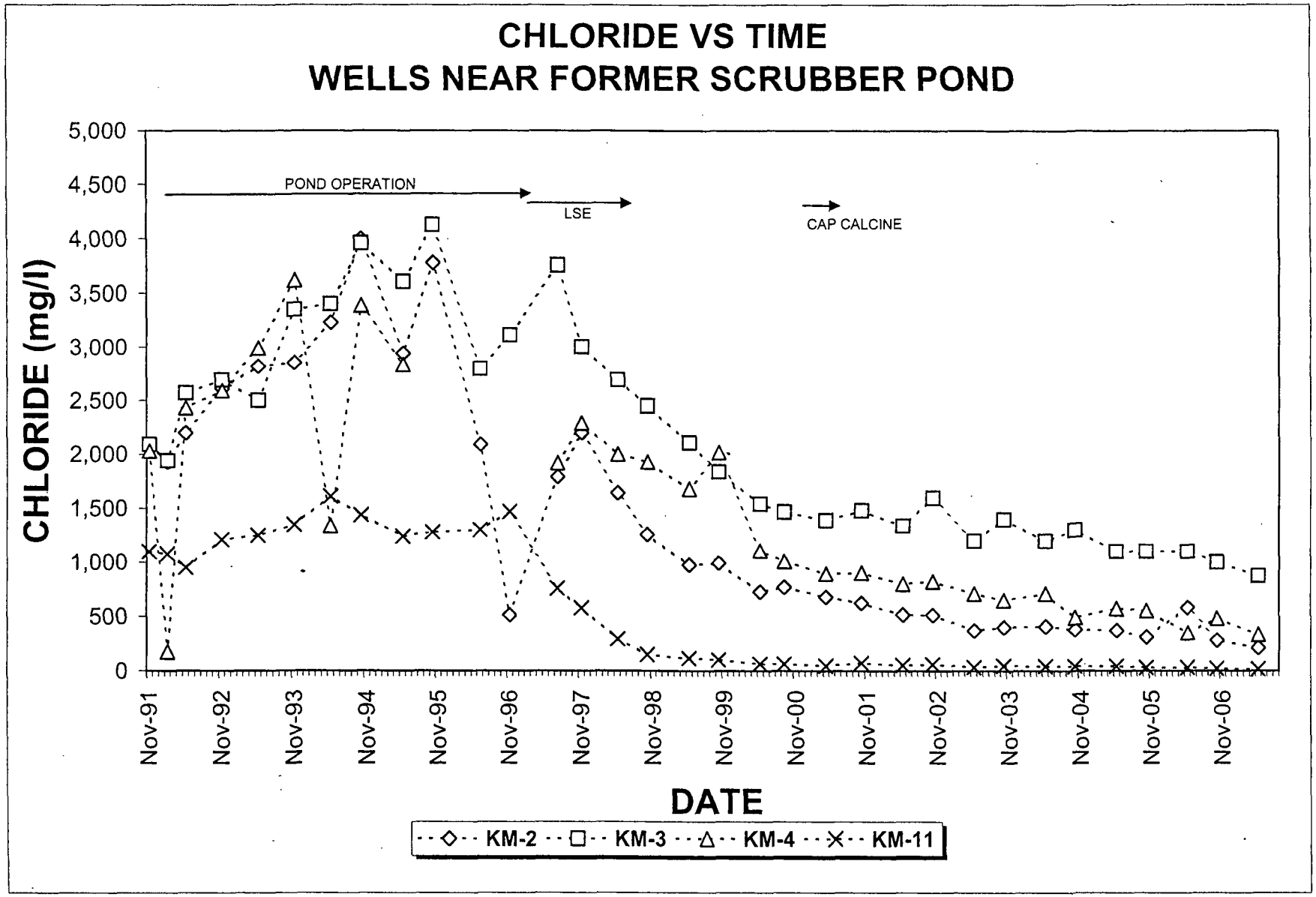
RBC FOR ARSENIC IS 50 ug/l
KM-2, KM-3, KM-11 ARE POC WELLS
VALUES LESS THAN DETECTION ARE PLOTTED AT DETECTION LIMIT
ARSENIC DETECTION LIMIT AT 10 to 15 UG/L 1999 THROUGH 2007

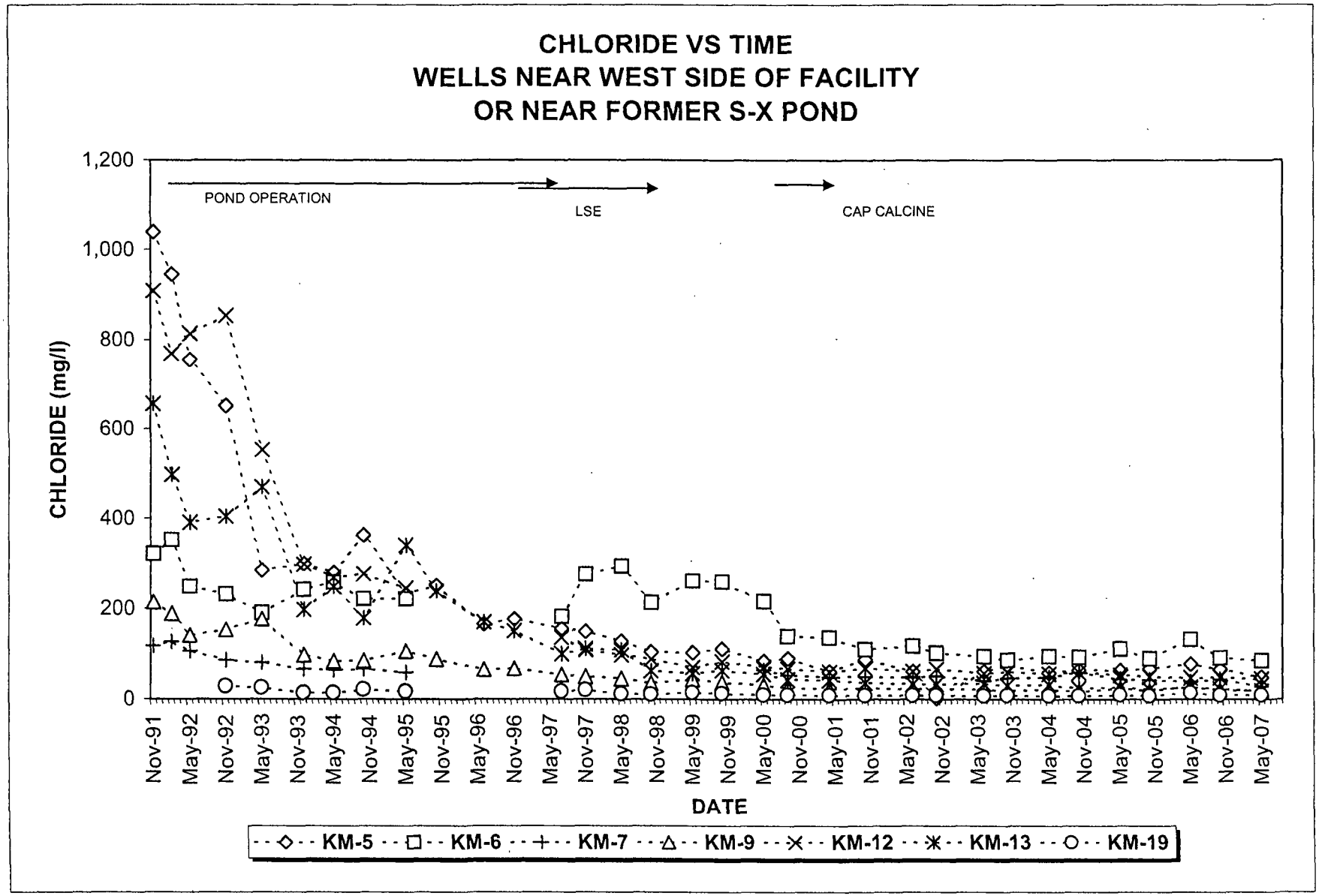


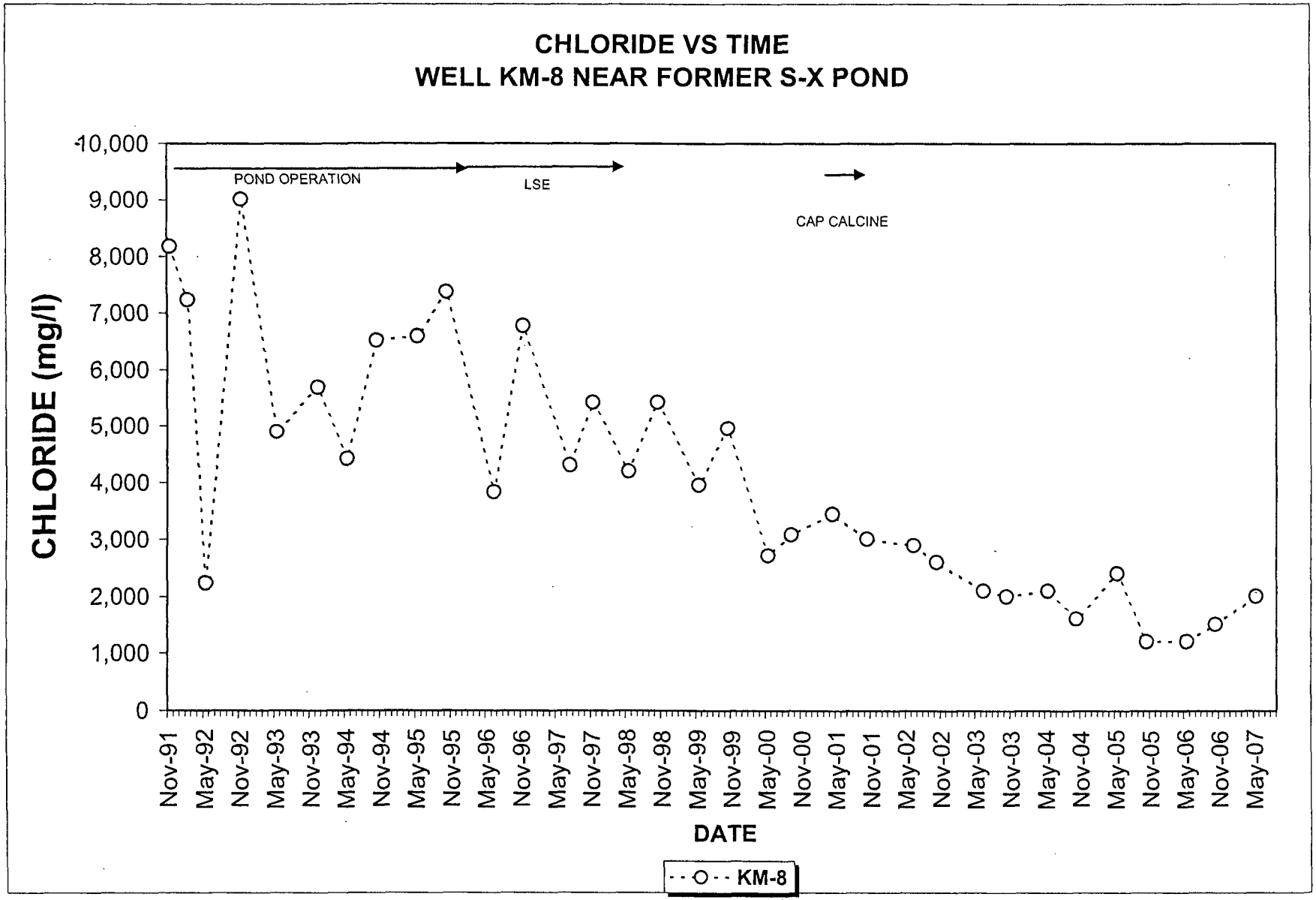
RBC FOR ARSENIC IS 50 ug/l
KM-5, KM-9, KM-12, KM-13, KM-19 ARE POC WELLS
VALUES LESS THAN DETECTION ARE PLOTTED AT THE DETECTION LIMIT
ARSENIC IS LESS THAN DETECTION OR REPORTING LIMIT IN ALL WELLS DURING 2003 through 2007

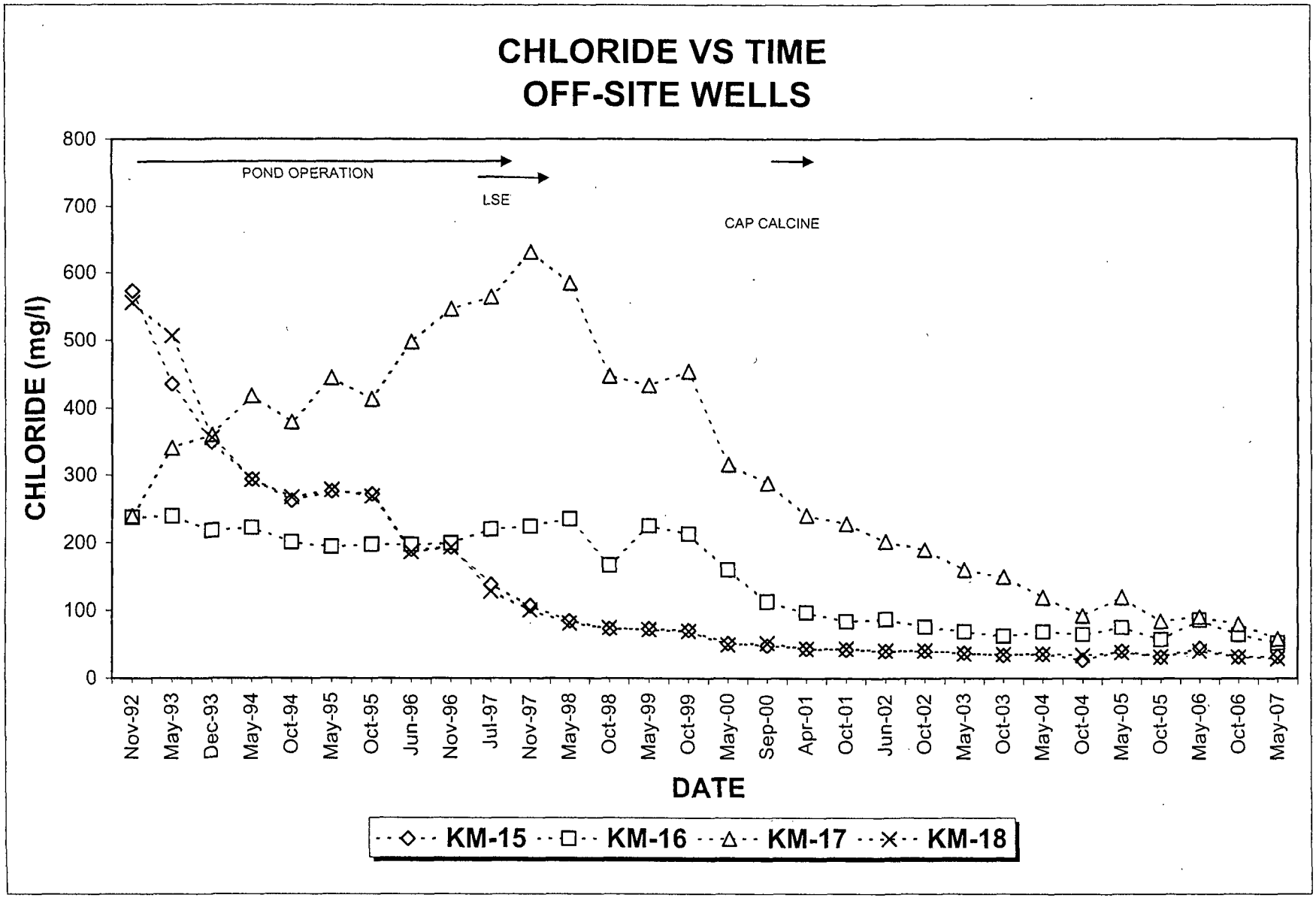


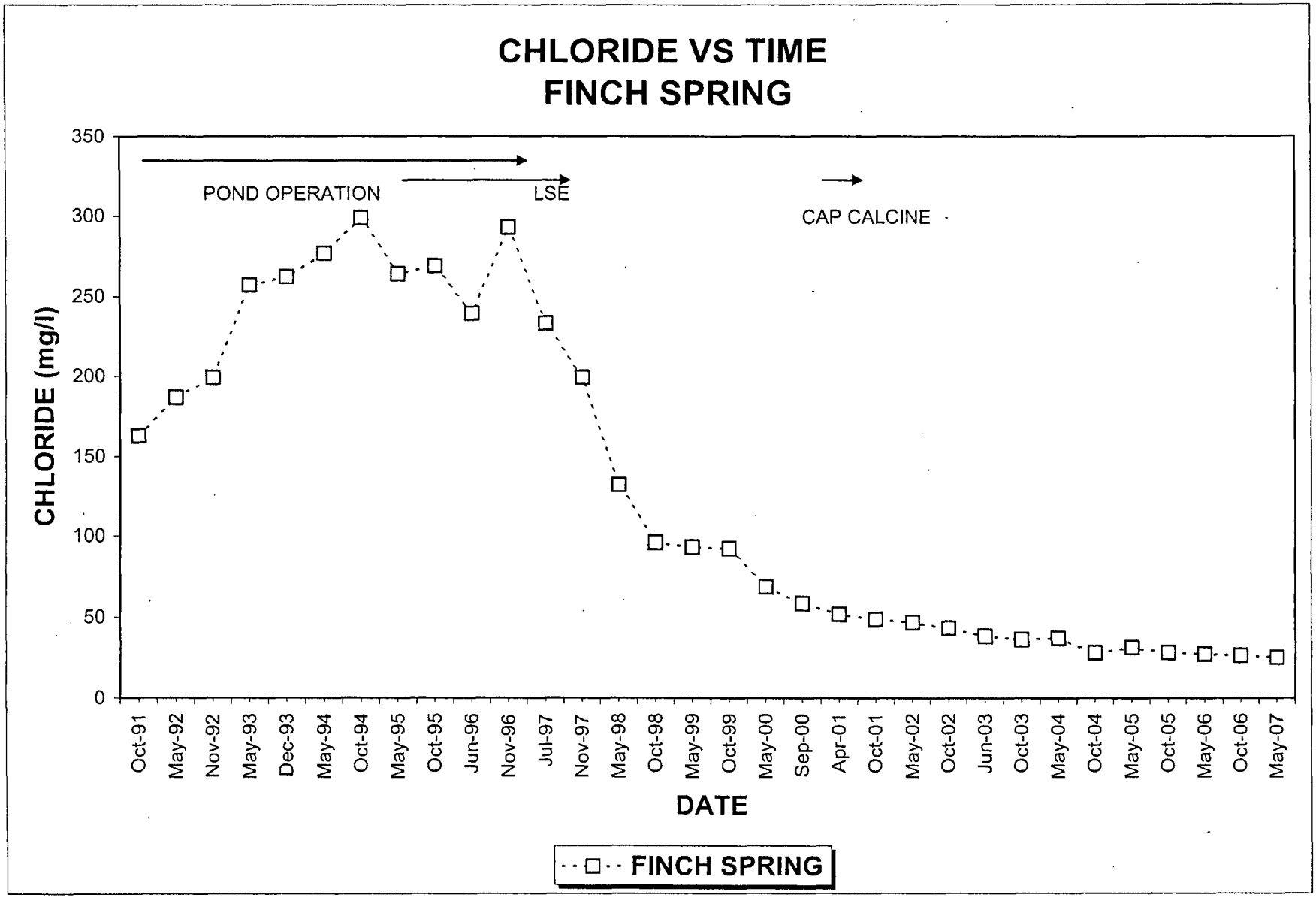
RBC FOR ARSENIC IS 50 ug/l
KM-8 IS A POC WELL
VALUES LESS THAN DETECTION ARE PLOTTED AT THE DETECTION LIMIT

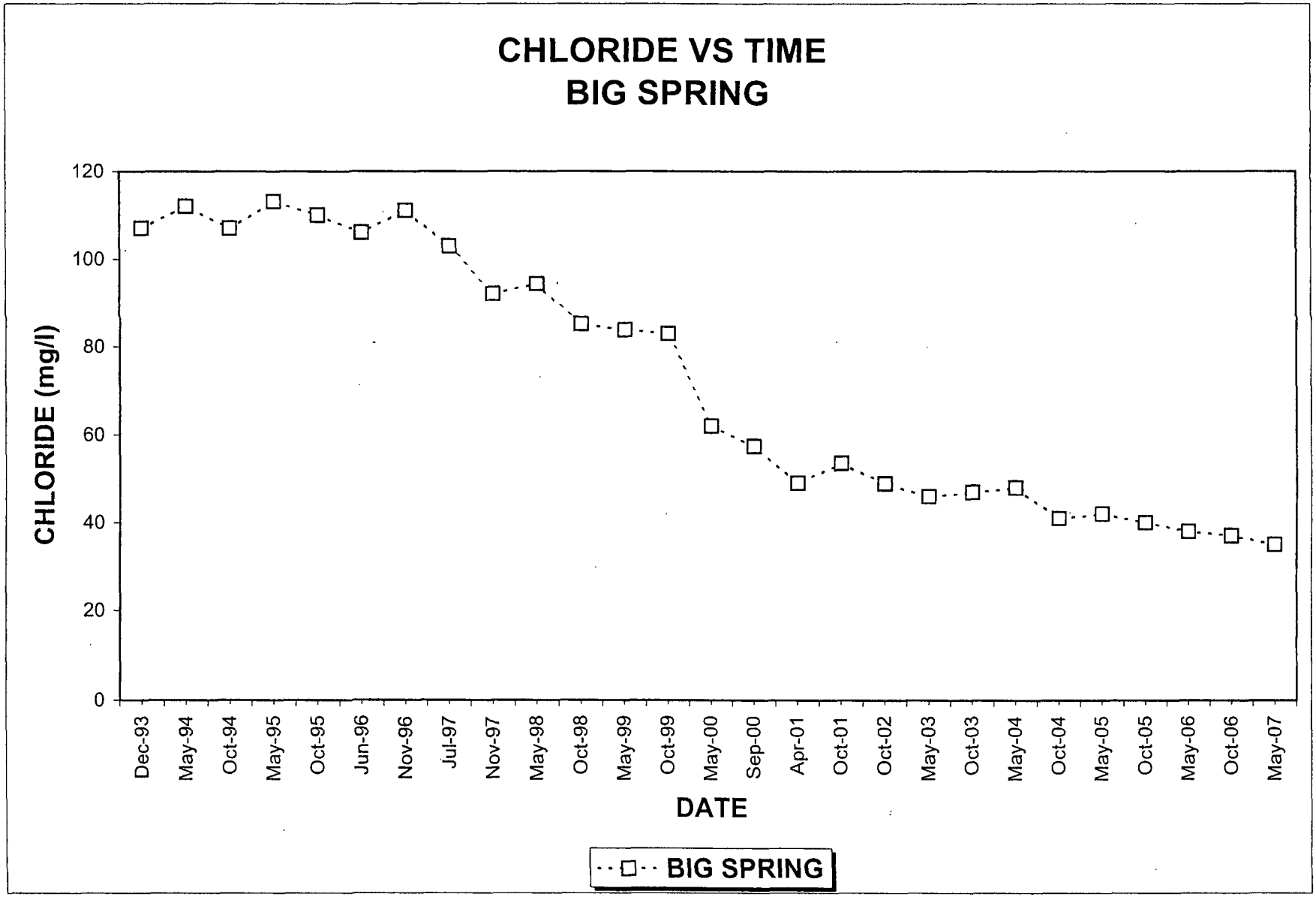

CHLORIDE VS TIME
WELLS NEAR FORMER SCRUBBER POND
CHLORIDE (mg/l)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
Nov-92
Nov-93
Nov-94
Nov-95
Nov-96
Nov-97
Nov-98
Nov-99
Nov-00
Nov-01
Nov-02
Nov-03
Nov-04
Nov-05
Nov-06
DATE
KM-2
KM-3
KM-4
KM-11


CHLORIDE VS TIME
WELLS NEAR WEST SIDE OF FACILITY
OR NEAR FORMER S-X POND
POND OPERATION
LSE
CAP CALCINE
CHLORIDE (mg/l)
1,200
1,000
800
600
400
200
0
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-5
KM-6
KM-7
KM-9
KM-12
KM-13
KM-19


CHLORIDE VS TIME
WELL KM-8 NEAR FORMER S-X POND
CHLORIDE (mg/l)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-8


CHLORIDE VS TIME
OFF-SITE WELLS
POND OPERATION
LSE
CAP CALCINE
CHLORIDE (mg/l)
800
700
600
500
400
300
200
100
0
Nov-92
May-93
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
Jun-02
Oct-02
May-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
KM-15
KM-16
KM-17
KM-18


CHLORIDE VS TIME
FINCH SPRING
POND OPERATION
LSE
CAP CALCINE
CHLORIDE (mg/l)
350
300
250
200
150
100
50
0
Oct-91
May-92
Nov-92
May-93
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
Jun-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
FINCH SPRING


CHLORIDE VS TIME
BIG SPRING
CHLORIDE (mg/l)
120
100
80
60
40
20
0
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
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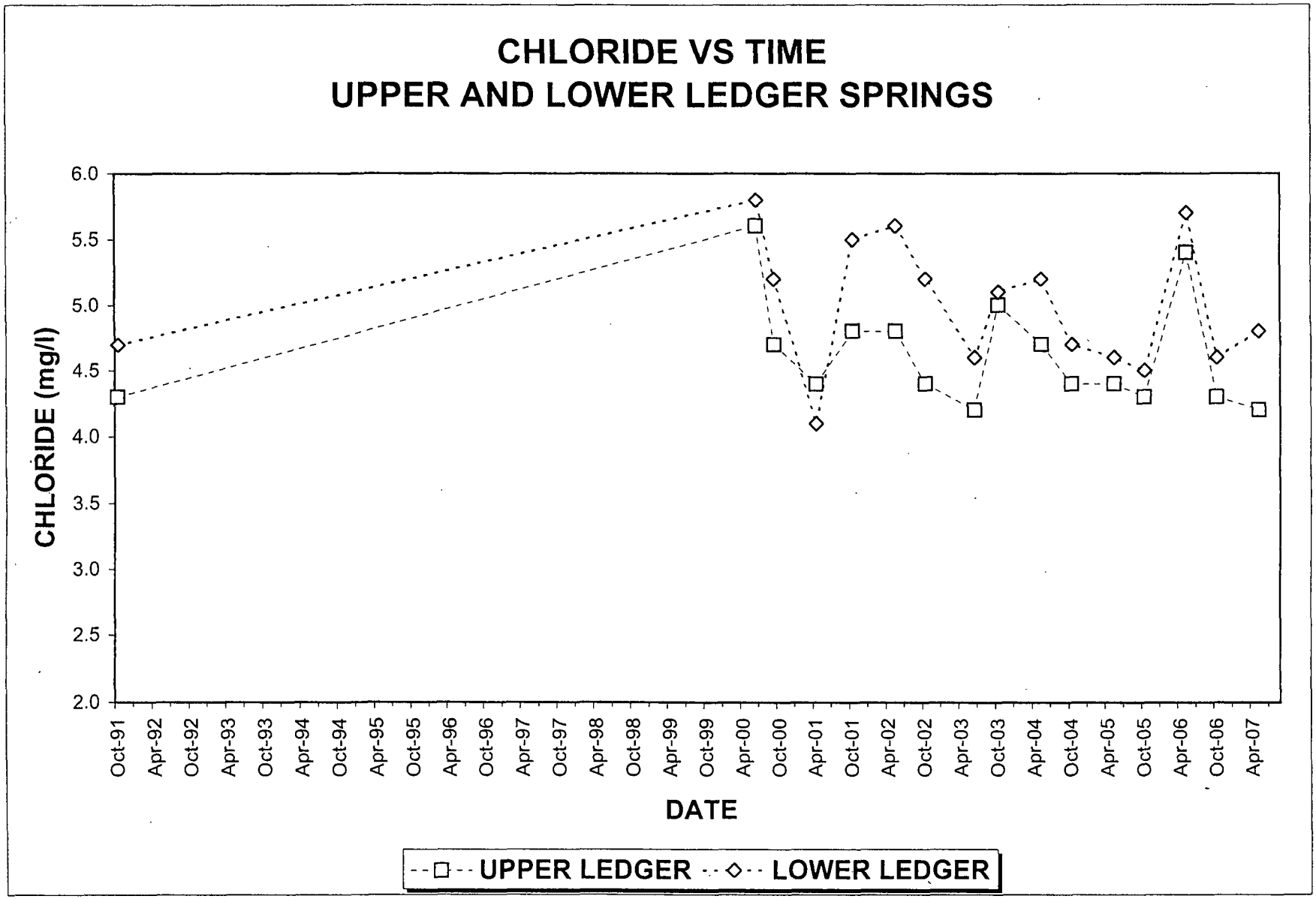
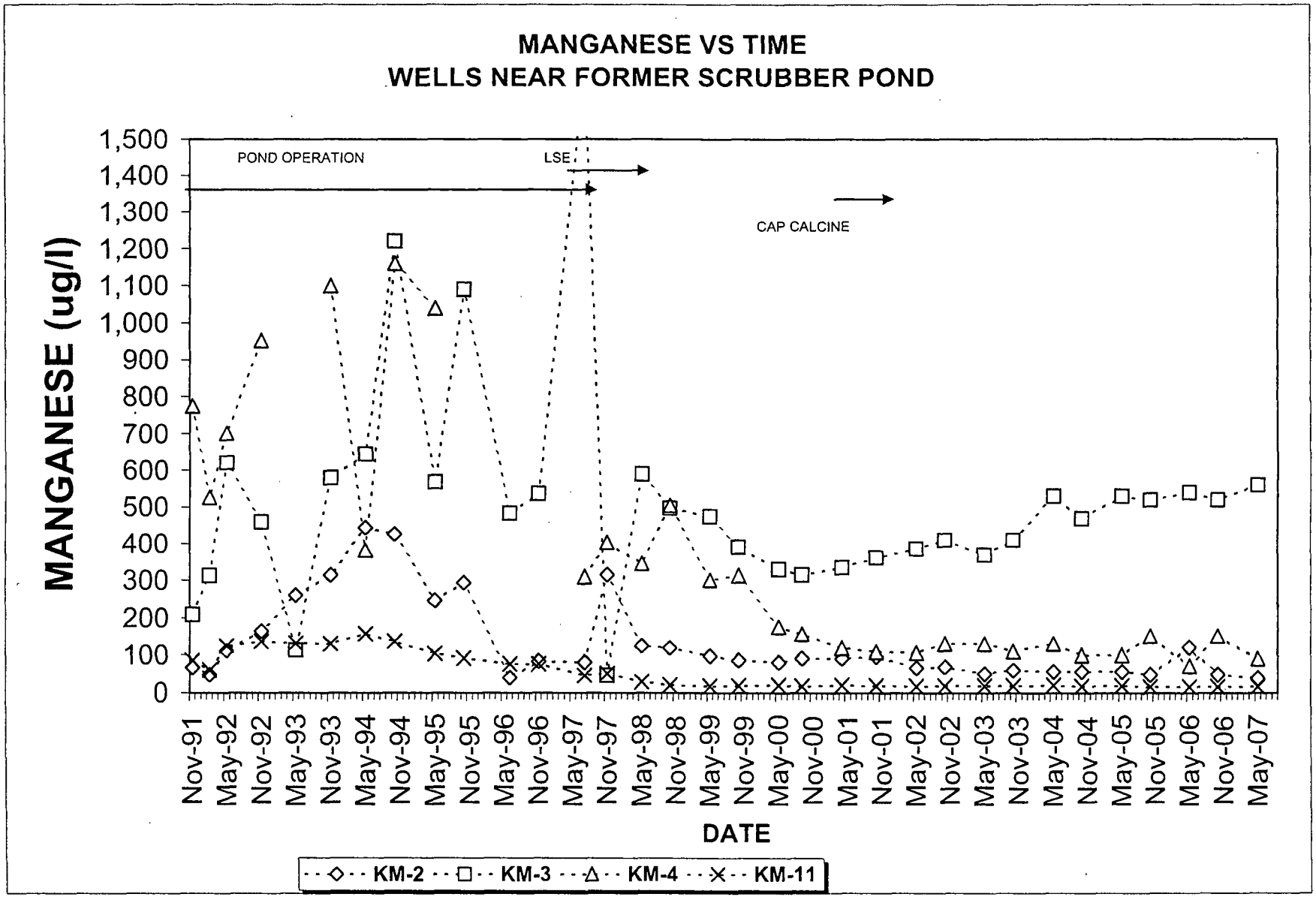
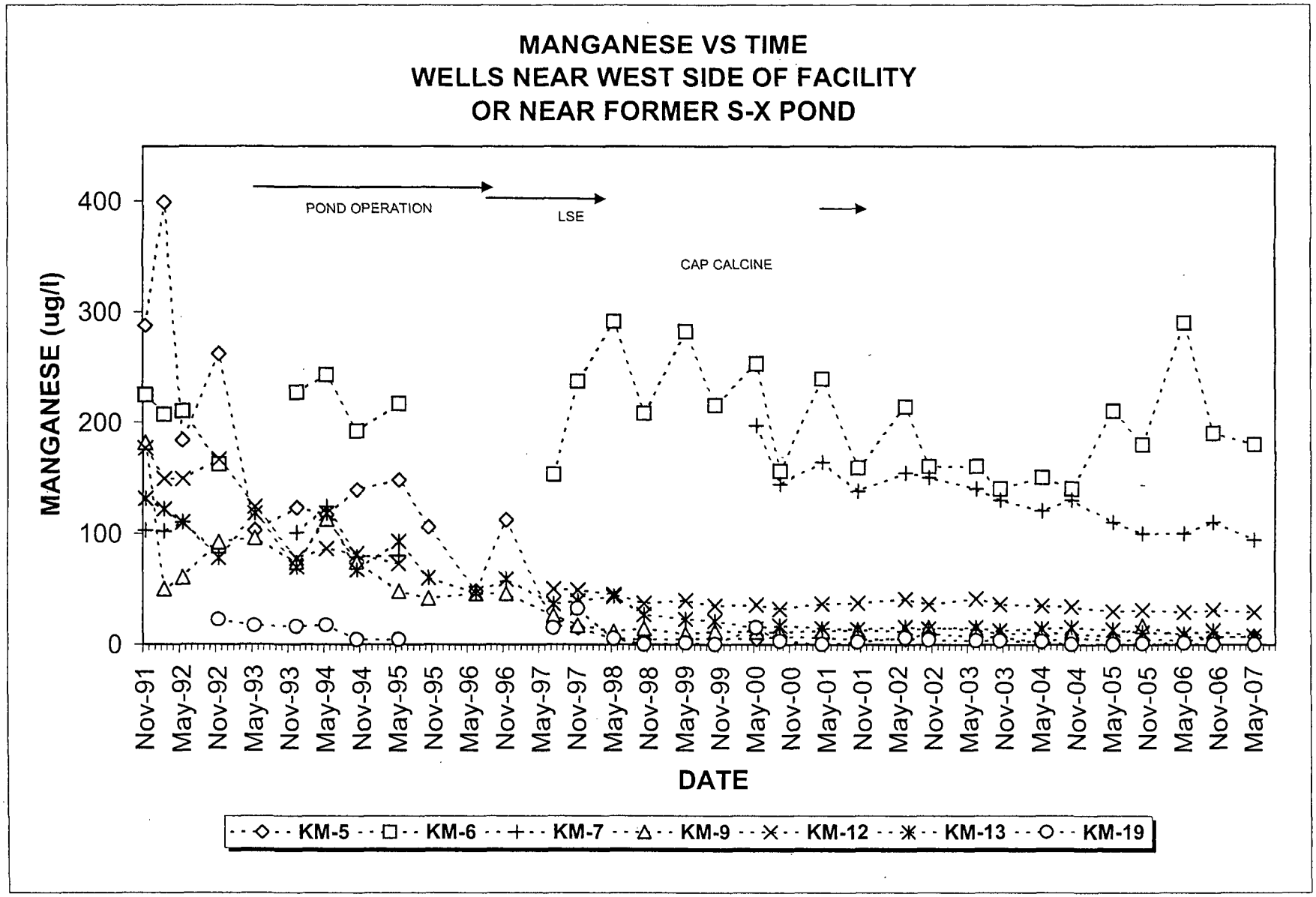
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
BIG SPRING

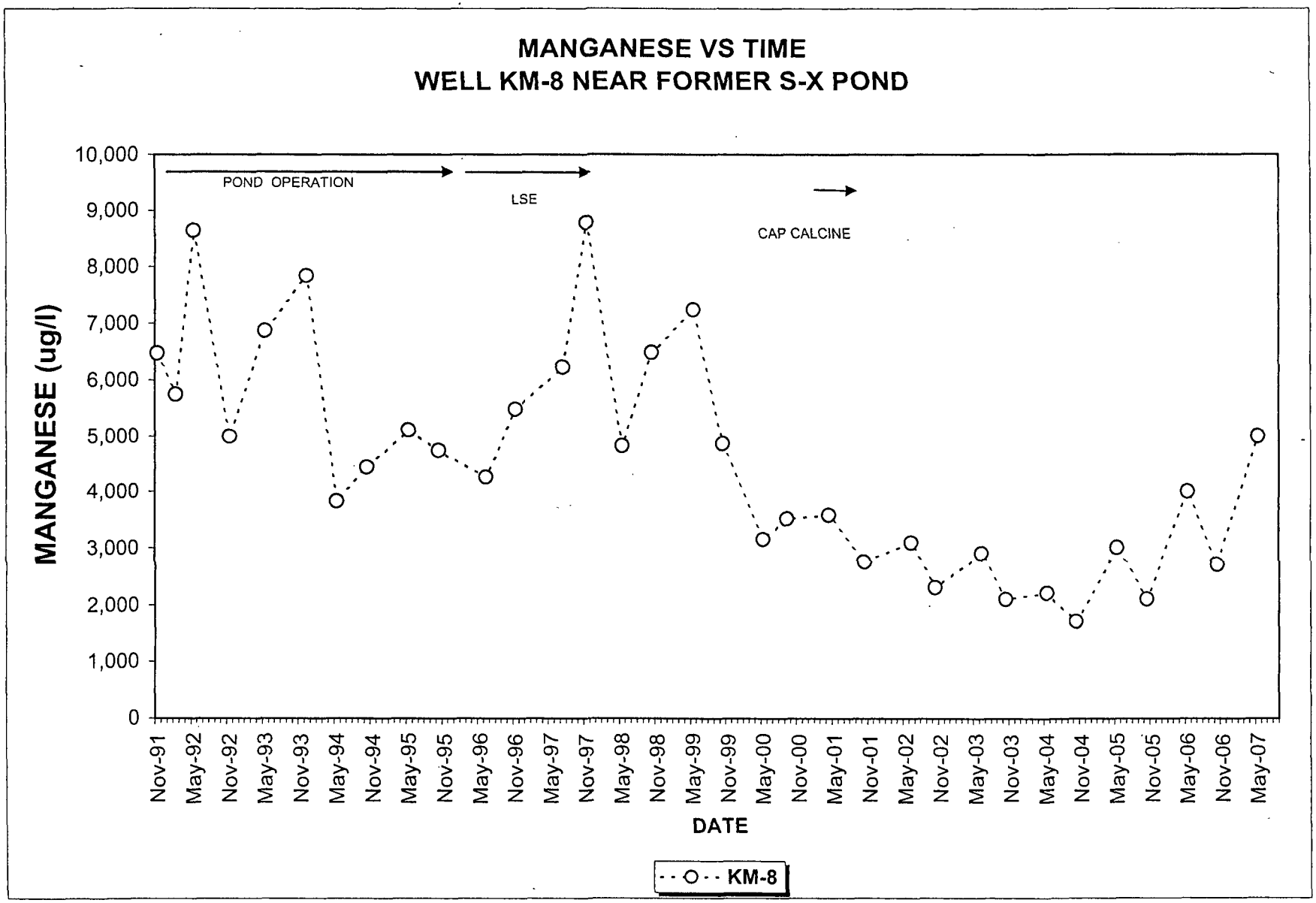

CHLORIDE VS TIME
UPPER AND LOWER LEDGER SPRINGS
CHLORIDE (mg/l)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
Oct-91
Apr-92
Oct-92
Apr-93
Oct-93
Apr-94
Oct-94
Apr-95
Oct-95
Apr-96
Oct-96
Apr-97
Oct-97
Apr-98
Oct-98
Apr-99
Oct-99
Apr-00
Oct-00
Apr-01
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03
Apr-04
Oct-04
Apr-05
Oct-05
Apr-06
Oct-06
Apr-07
DATE
UPPER LEDGER
LOWER LEDGER



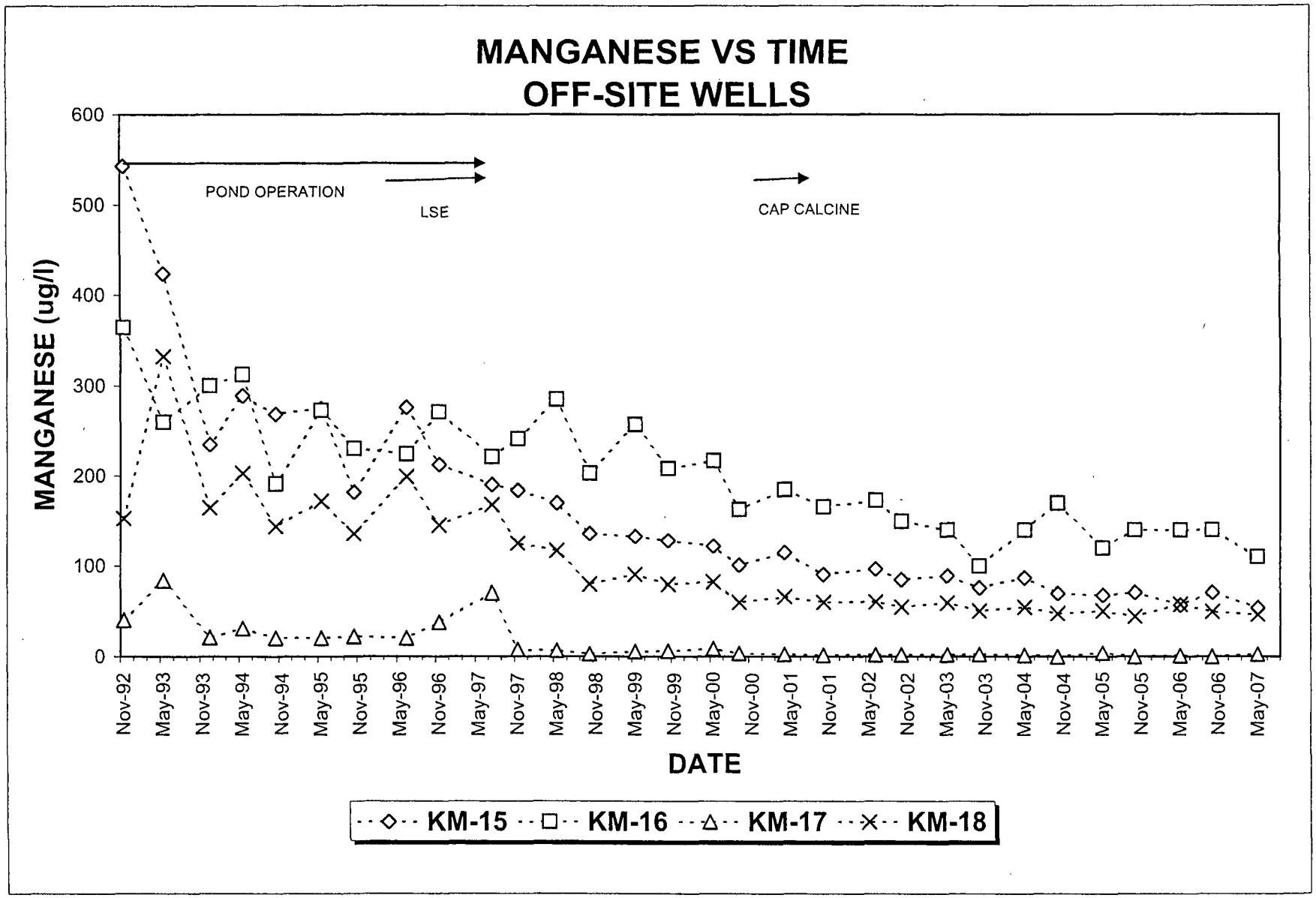
RBC FOR MANGANESE IS 180 ug/l
KM-2, KM-3, KM-11 ARE POC WELLS

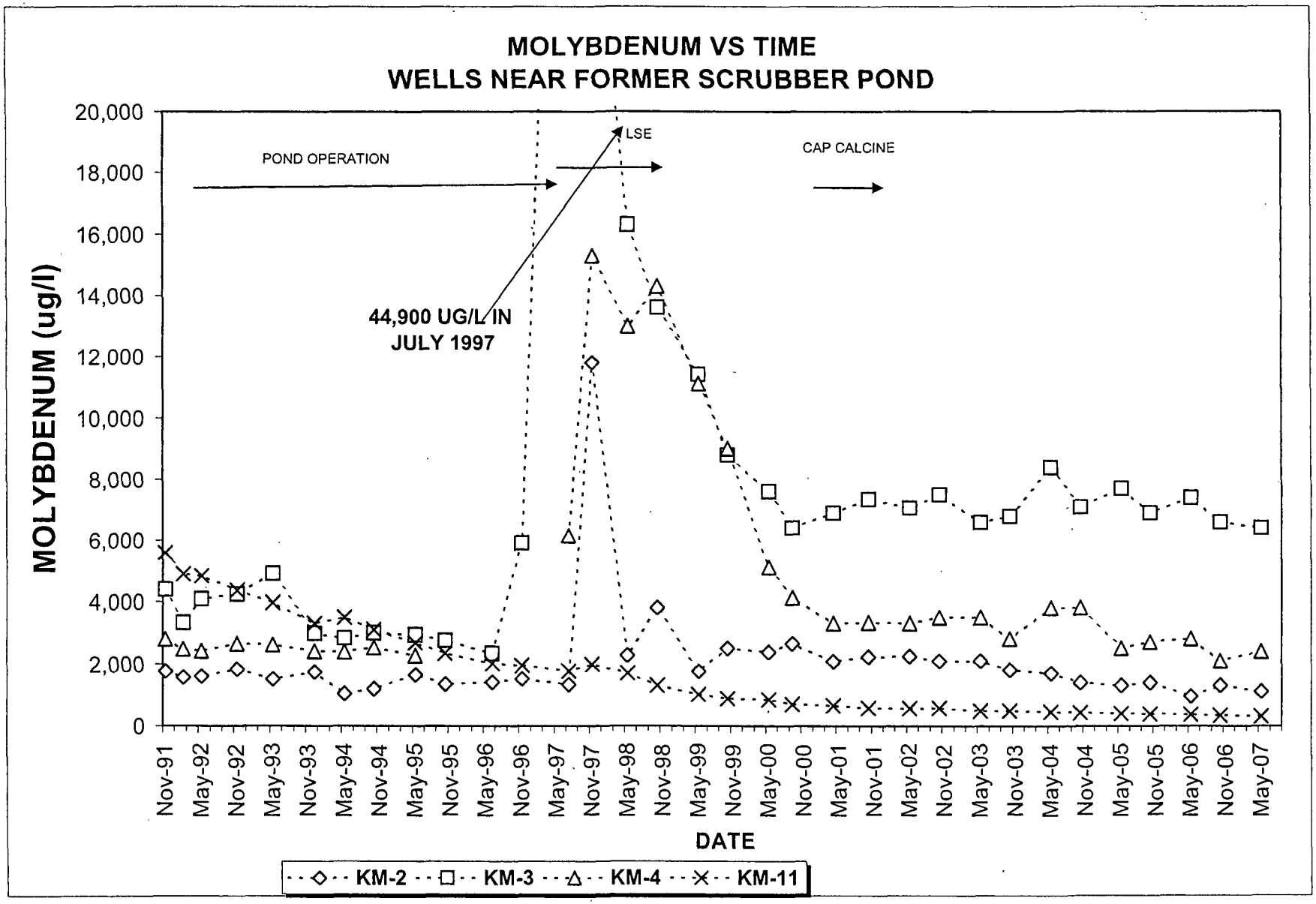


RBC FOR MANGANESE IS 180 ug/l
KM-5, KM-9, KM-12, KM-13, KM-19 ARE POC WELLS

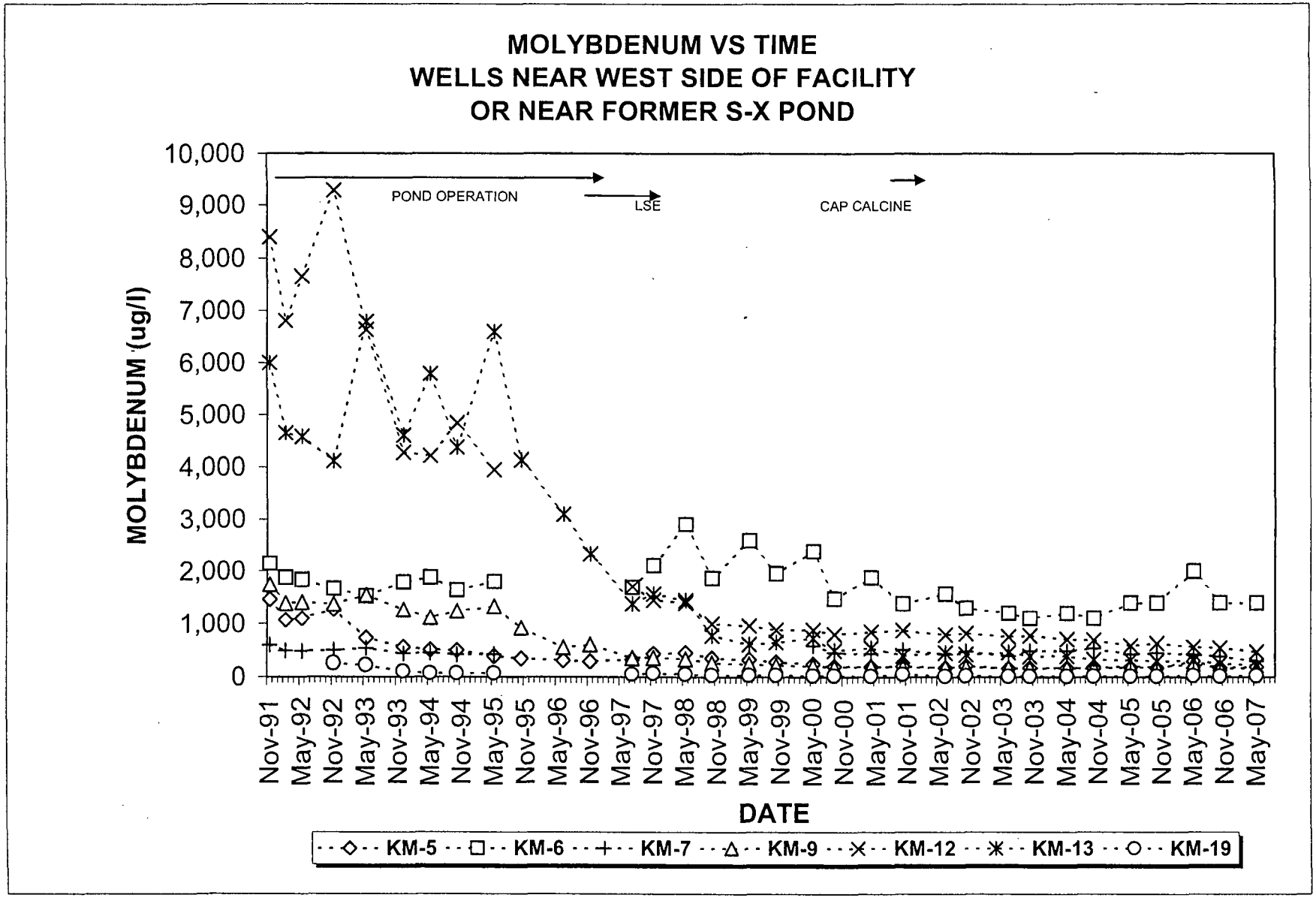


RBC FOR MANGANESE IS 180 ug/l
KM-8 IS A POC WELL

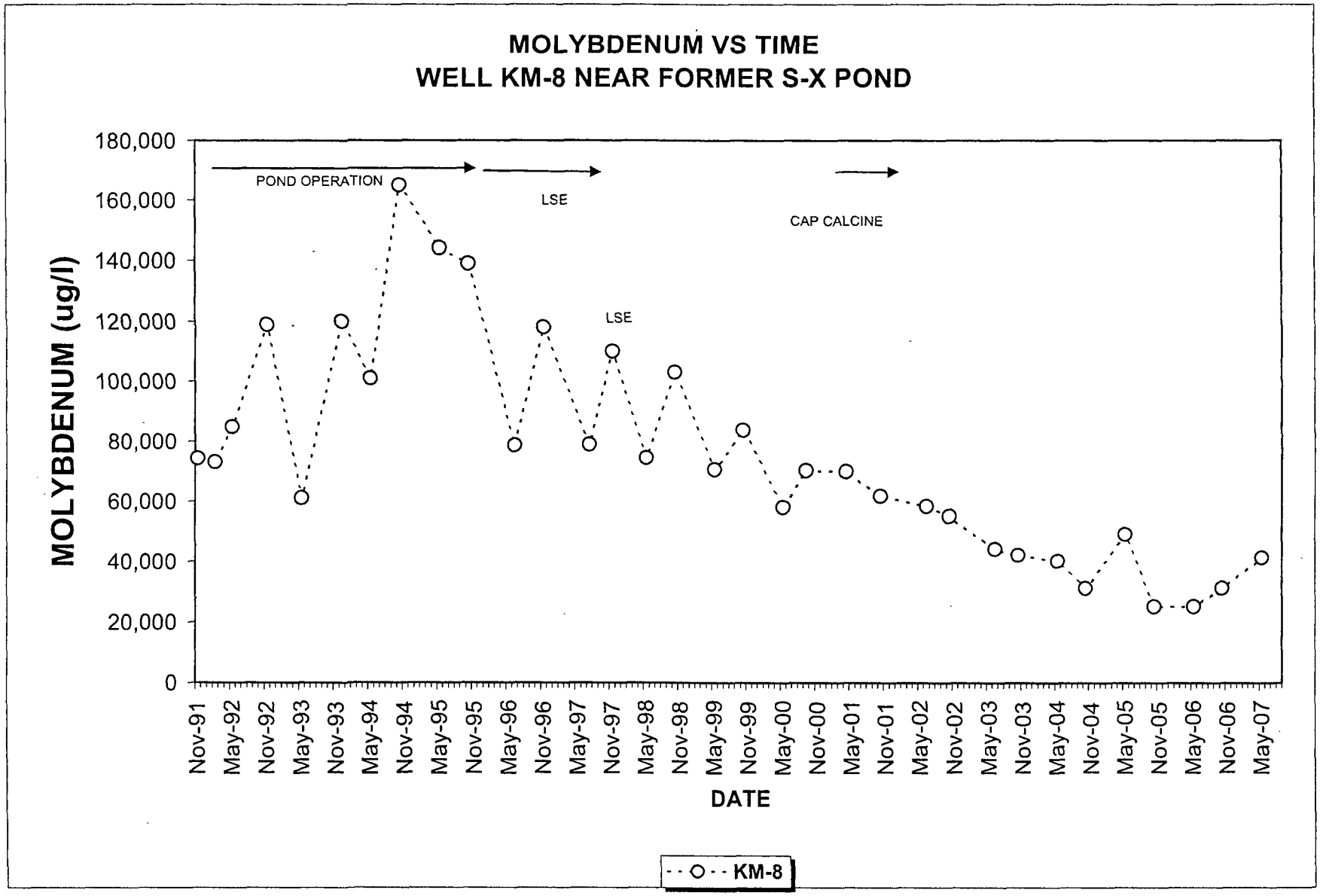

MANGANESE VS TIME
OFF-SITE WELLS
MANGANESE (ug/l)
600
500
400
300
200
100
0
POND OPERATION
LSE
CAP CALCINE
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-15
KM-16
KM-17
KM-18



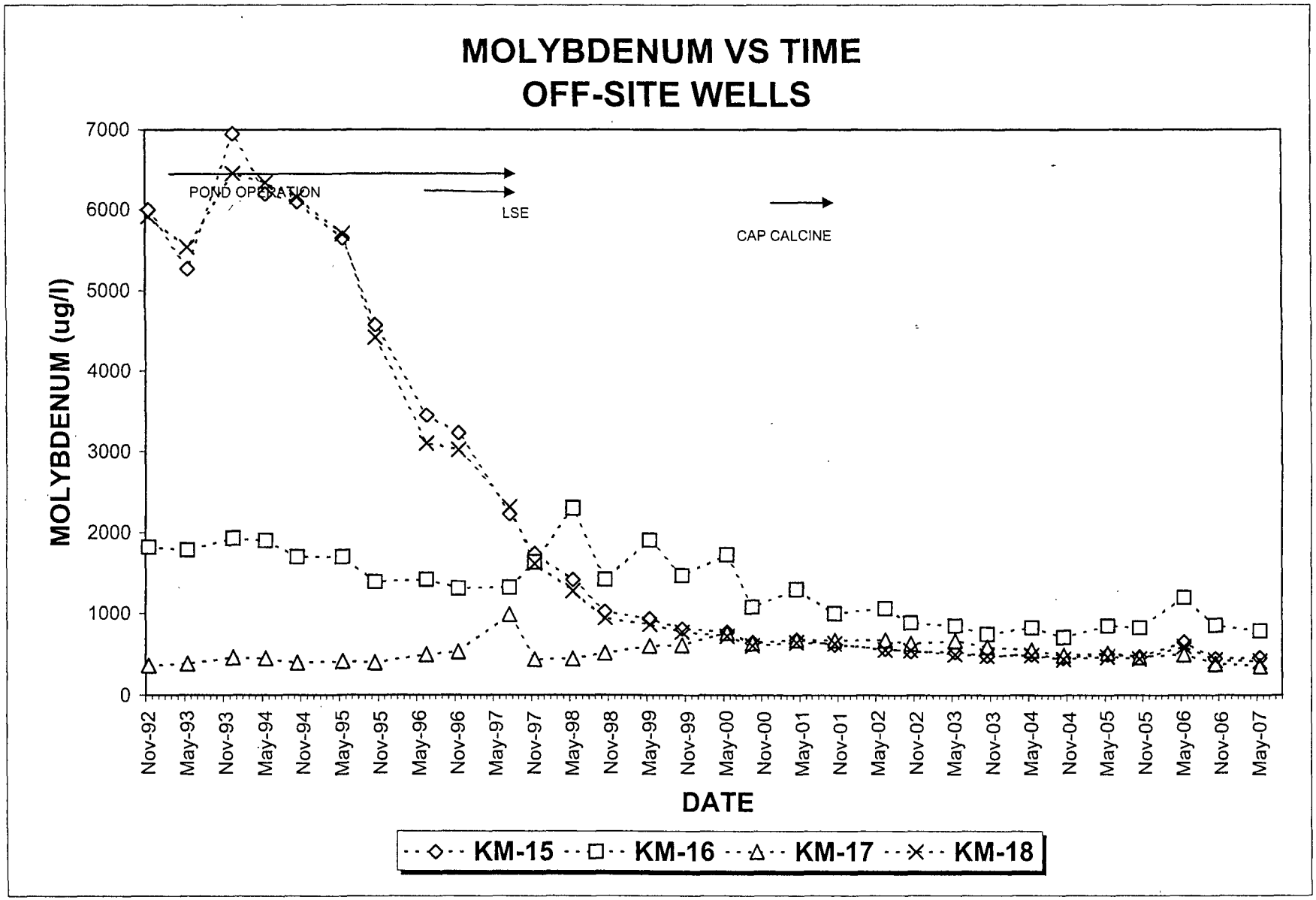
RBC FOR MOLYBDENUM IS 180 ug/l
KM-2, KM-3, KM-11 ARE POC WELLS



RBC FOR MOLYBDENUM IS 180 ug/l
KM-5, KM-9, KM-12, KM-13, KM-19 ARE POC WELLS



RBC FOR MOLYBDENUM IS 180 ug/l
KM-8 IS A POC WELL


MOLYBDENUM VS TIME
OFF-SITE WELLS
MOLYBDENUM (ug/l)
7000
6000
5000
4000
3000
2000
1000
0
POND OPERATION
LSE
CAP CALCINE
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
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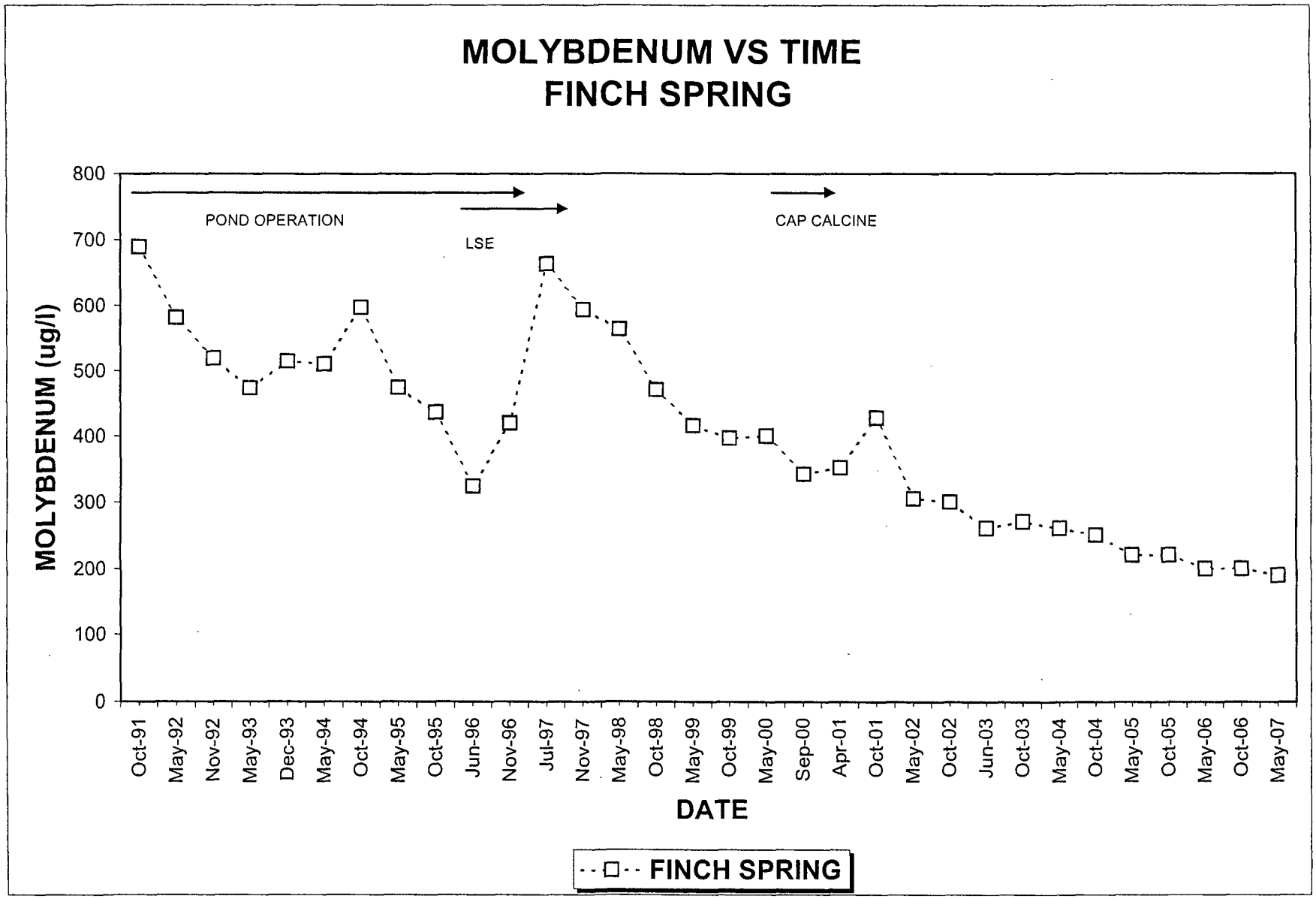
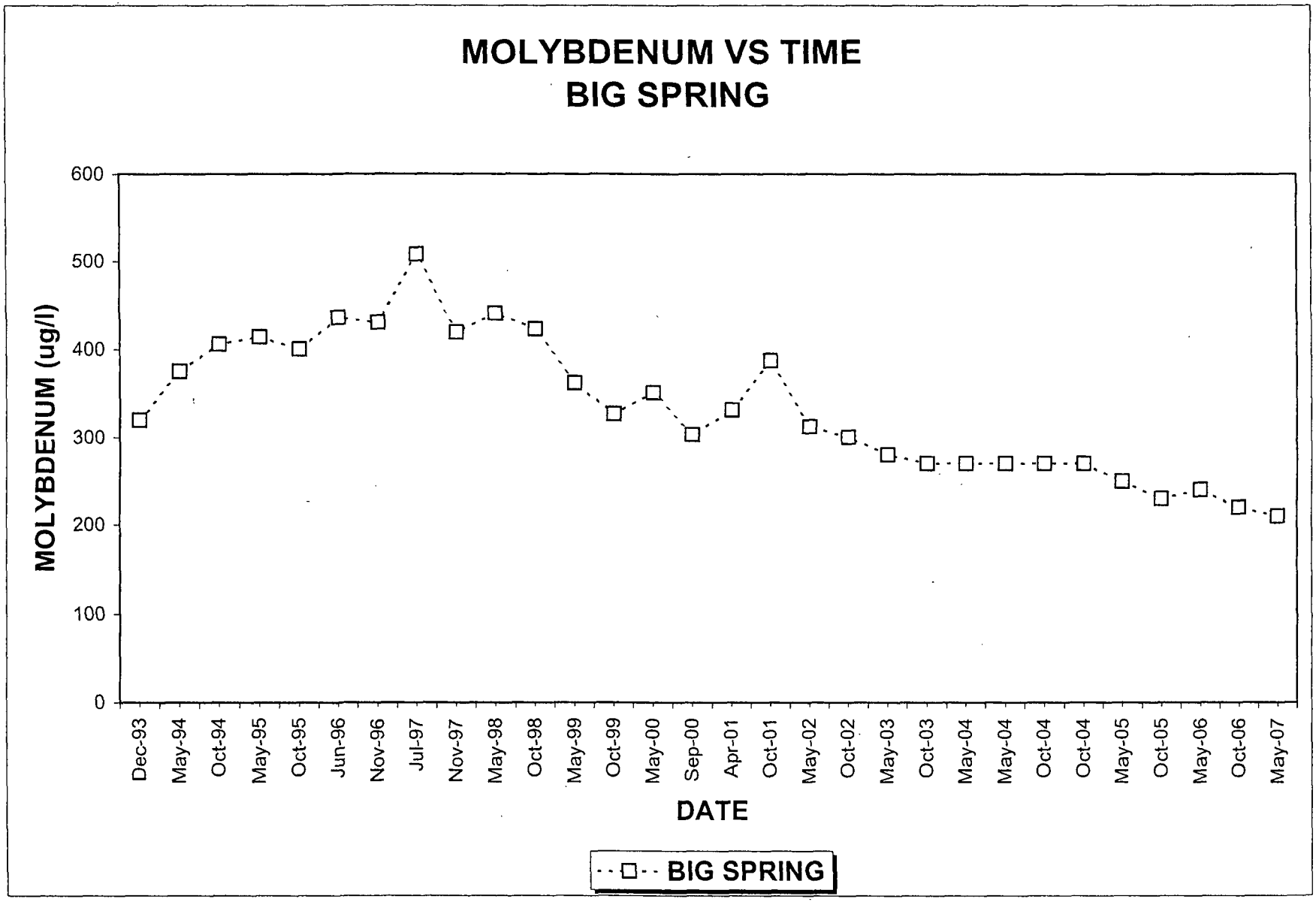
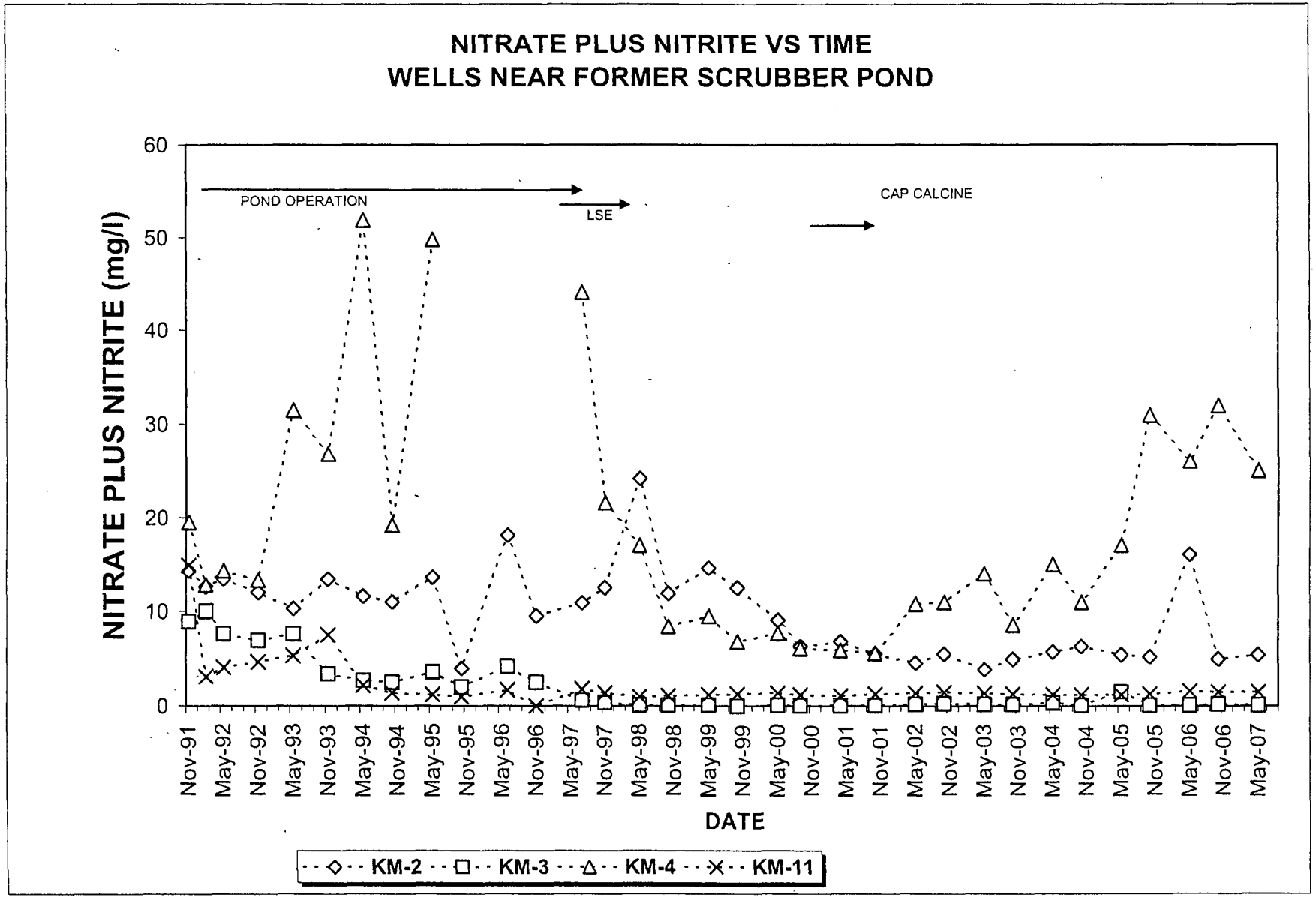
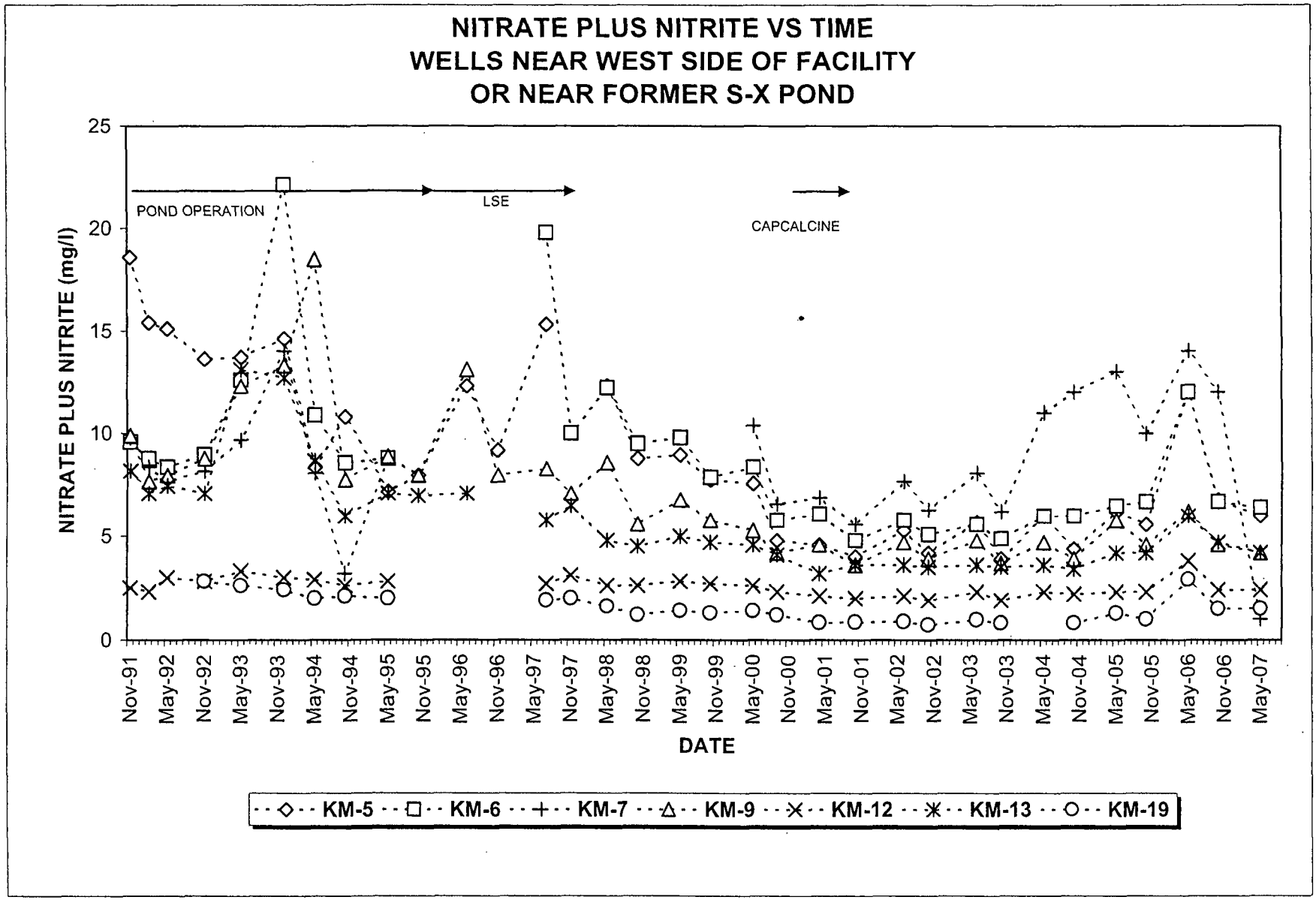
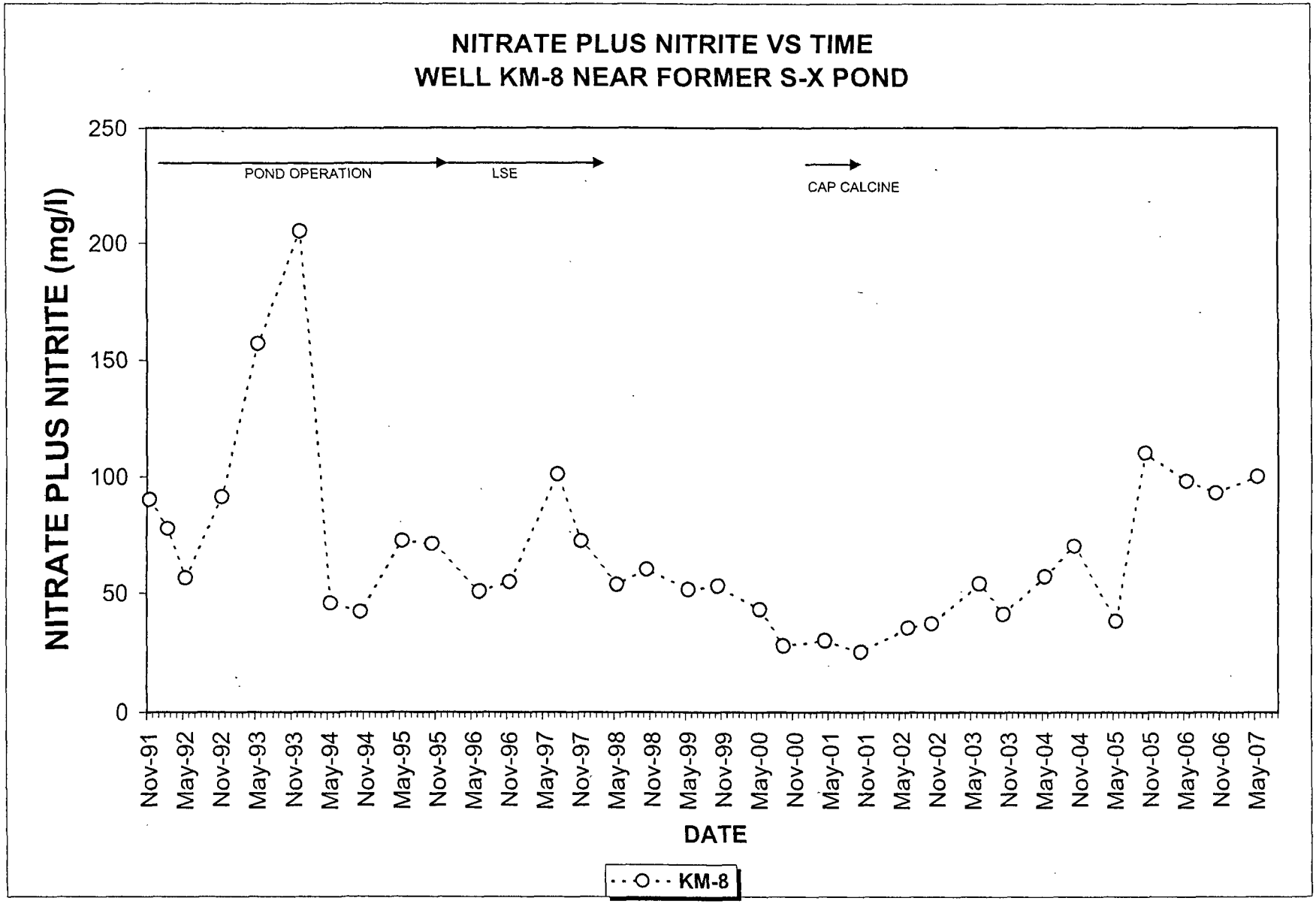
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-15
KM-16
KM-17
KM-18


MOLYBDENUM VS TIME
FINCH SPRING
POND OPERATION
LSE
CAP CALCINE
MOLYBDENUM (ug/l)
800
700
600
500
400
300
200
100
0
Oct-91
May-92
Nov-92
May-93
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
Jun-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
FINCH SPRING


MOLYBDENUM VS TIME
BIG SPRING
MOLYBDENUM (ug/l)
600
500
400
300
200
100
0
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
May-04
Oct-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
BIG SPRING


NITRATE PLUS NITRITE VS TIME
WELLS NEAR FORMER SCRUBBER POND
NITRATE PLUS NITRITE (mg/l)
60
50
40
30
20
10
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-2
KM-3
KM-4
KM-11


NITRATE PLUS NITRITE VS TIME
WELLS NEAR WEST SIDE OF FACILITY
OR NEAR FORMER S-X POND
NITRATE PLUS NITRITE (mg/l)
25
20
15
10
5
0
POND OPERATION
LSE
CAPCALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-5
KM-6
KM-7
KM-9
KM-12
KM-13
KM-19


NITRATE PLUS NITRITE VS TIME
WELL KM-8 NEAR FORMER S-X POND
NITRATE PLUS NITRITE (mg/l)
250
200
150
100
50
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
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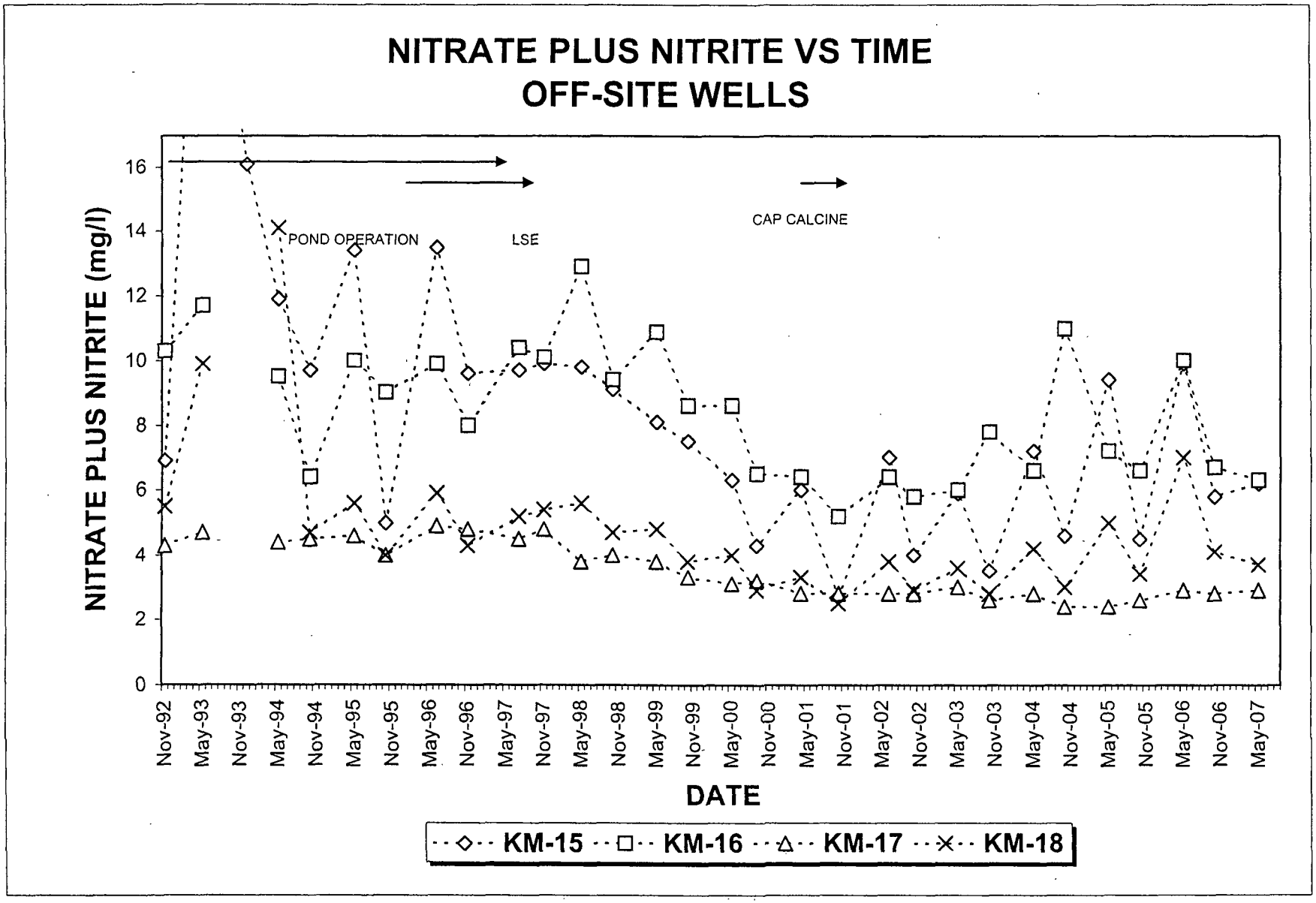
Nov-06
May-07
DATE
KM-8


NITRATE PLUS NITRITE VS TIME
OFF-SITE WELLS
NITRATE PLUS NITRITE (mg/l)
0
2
4
6
8
10
12
14
16
POND OPERATION
LSE
CAP CALCINE
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
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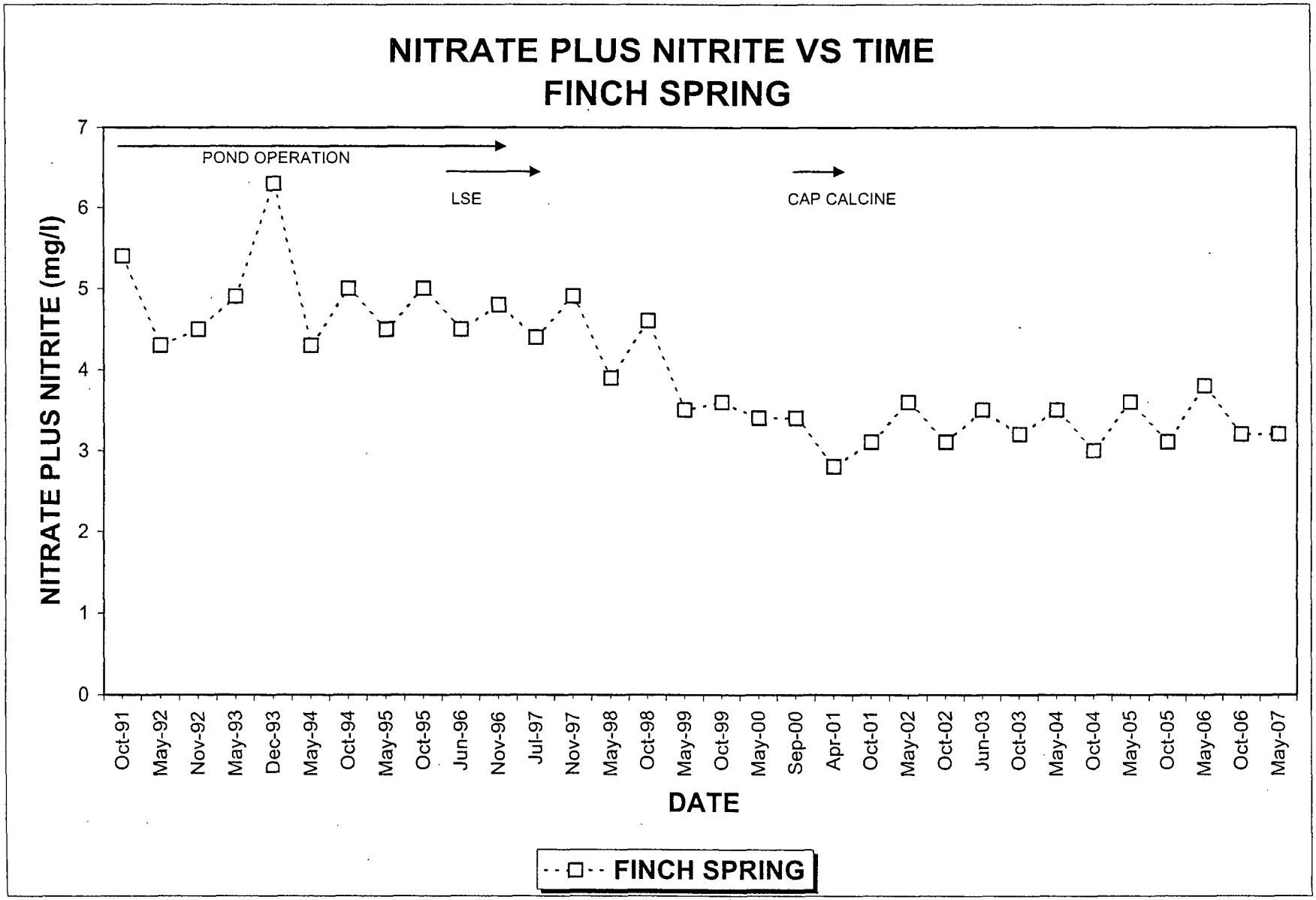
DATE
KM-15
KM-16
KM-17
KM-18


NITRATE PLUS NITRITE VS TIME
FINCH SPRING
POND OPERATION
LSE
CAP CALCINE
NITRATE PLUS NITRITE (mg/l)
0
1
2
3
4
5
6
7
Oct-91
May-92
Nov-92
May-93
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
Jun-03
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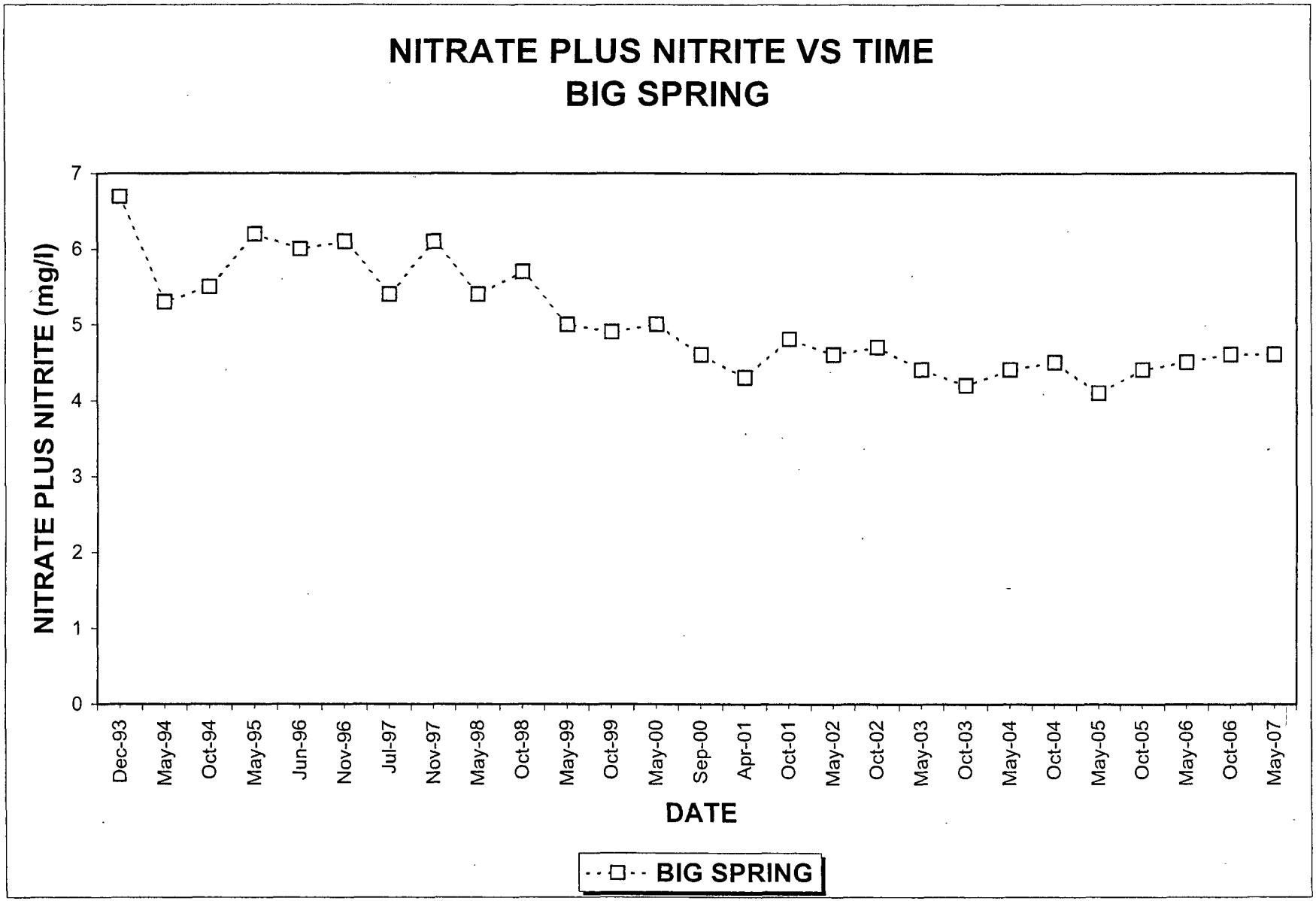
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
FINCH SPRING


NITRATE PLUS NITRITE VS TIME
BIG SPRING
NITRATE PLUS NITRITE (mg/l)
0
1
2
3
4
5
6
7
Dec-93
May-94
Oct-94
May-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
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May-04
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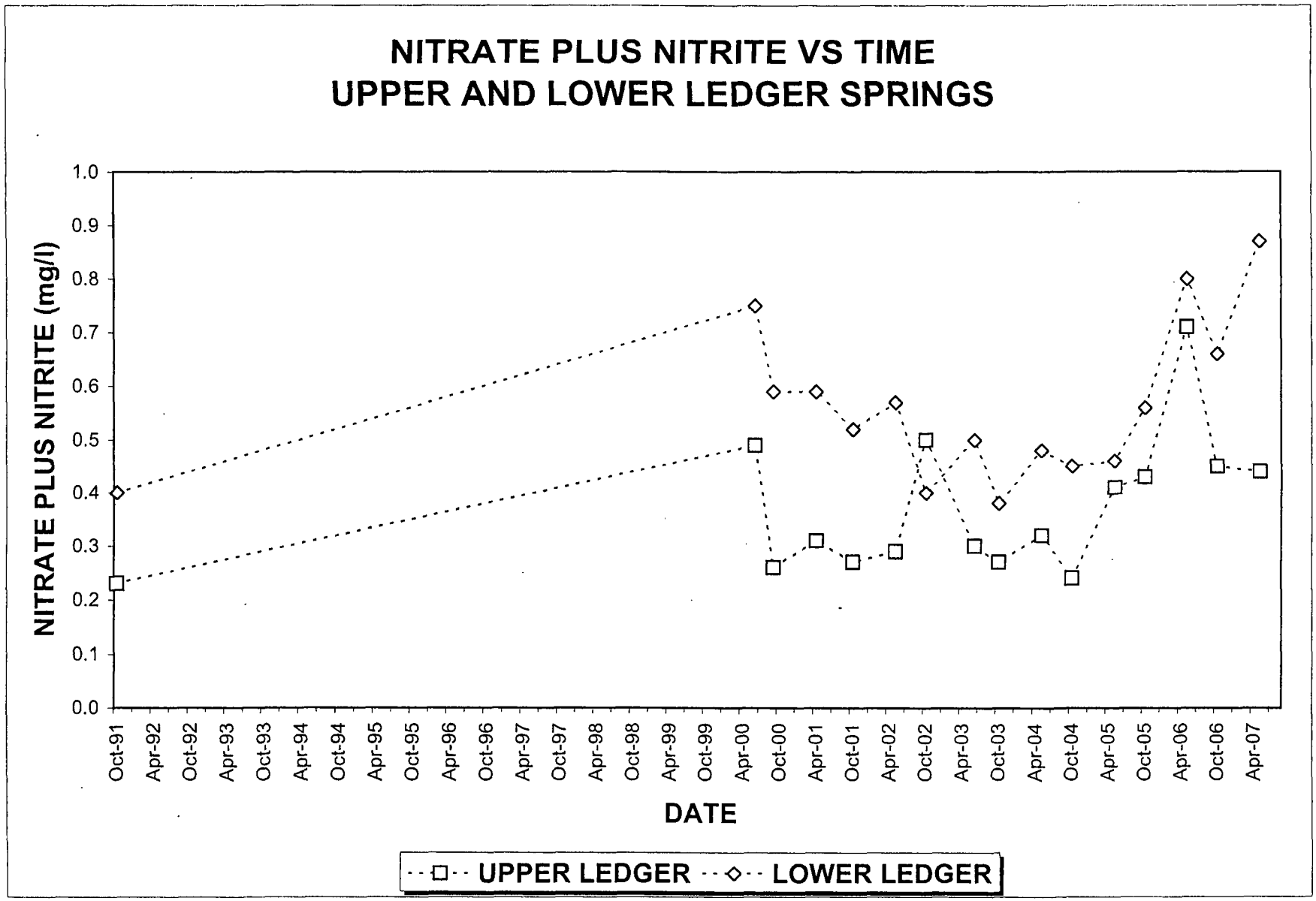
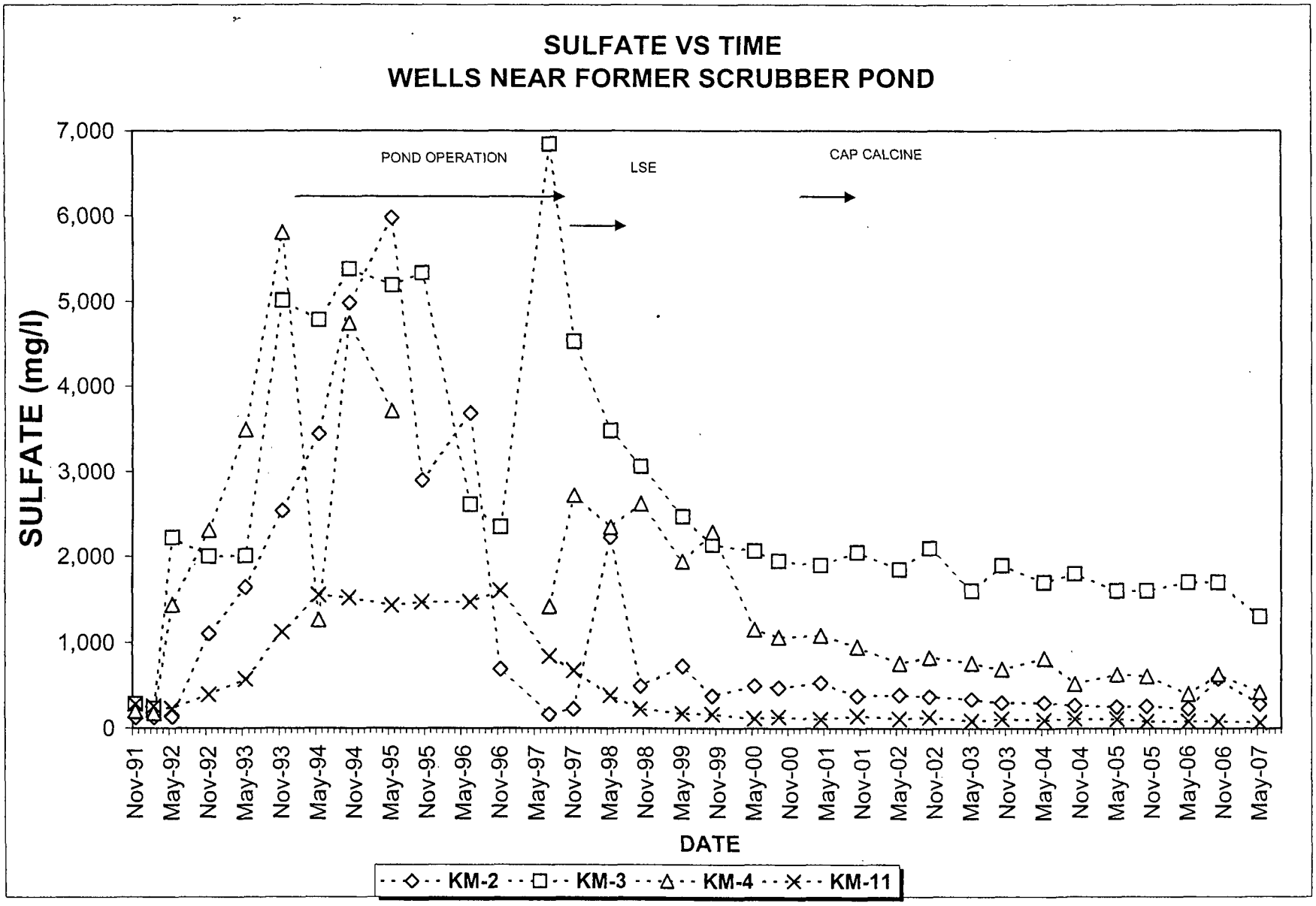
May-05
Oct-05
May-06
Oct-06
May-07
DATE
BIG SPRING


NITRATE PLUS NITRITE VS TIME
UPPER AND LOWER LEDGER SPRINGS
NITRATE PLUS NITRITE (mg/l)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Oct-91
Apr-92
Oct-92
Apr-93
Oct-93
Apr-94
Oct-94
Apr-95
Oct-95
Apr-96
Oct-96
Apr-97
Oct-97
Apr-98
Oct-98
Apr-99
Oct-99
Apr-00
Oct-00
Apr-01
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03
Apr-04
Oct-04
Apr-05
Oct-05
Apr-06
Oct-06
Apr-07
DATE
UPPER LEDGER
LOWER LEDGER


SULFATE VS TIME
WELLS NEAR FORMER SCRUBBER POND
SULFATE (mg/l)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
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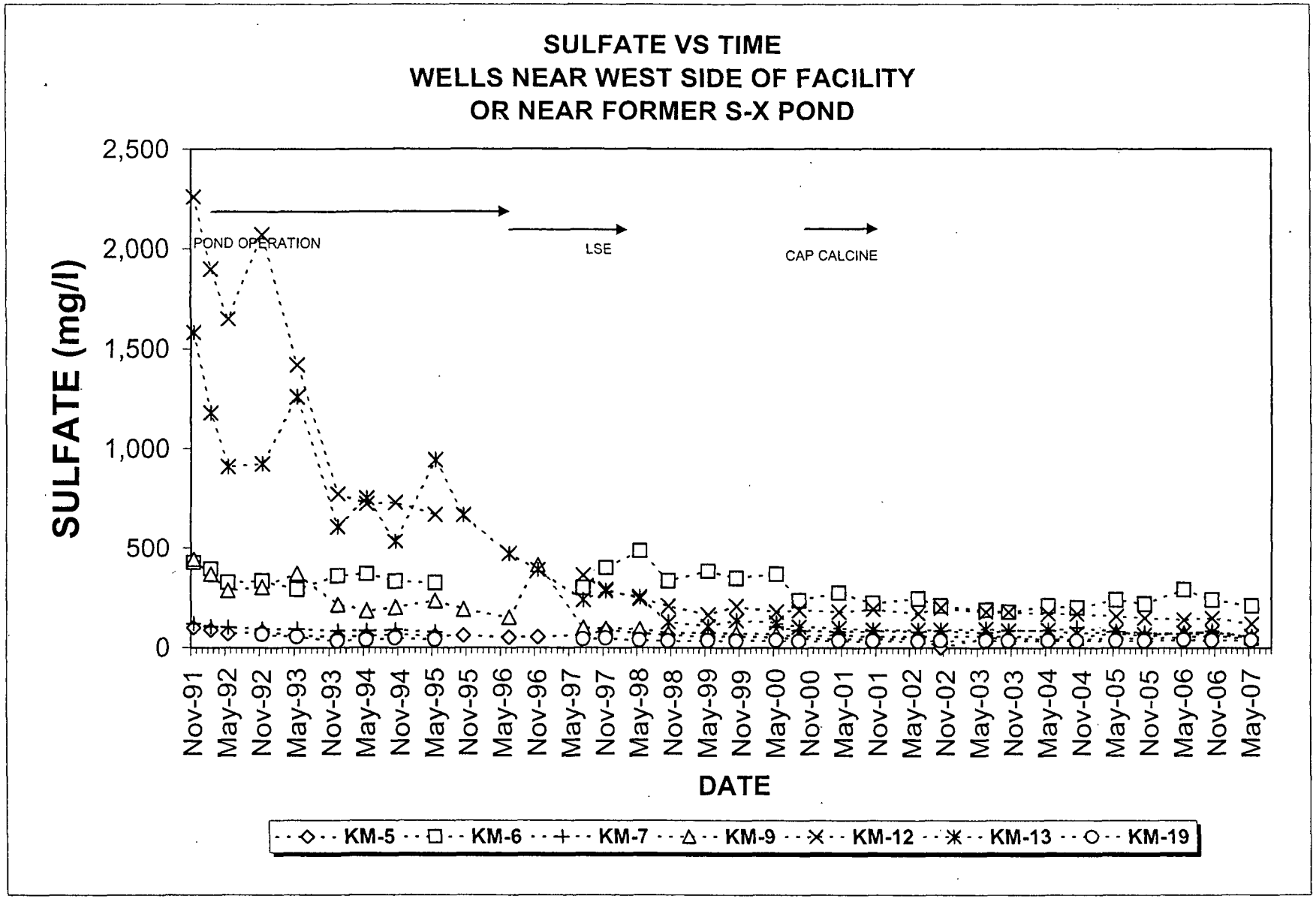
May-06
Nov-06
May-07
DATE
KM-2
KM-3
KM-4
KM-11


SULFATE VS TIME
WELLS NEAR WEST SIDE OF FACILITY
OR NEAR FORMER S-X POND
SULFATE (mg/l)
2,500
2,000
1,500
1,000
500
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
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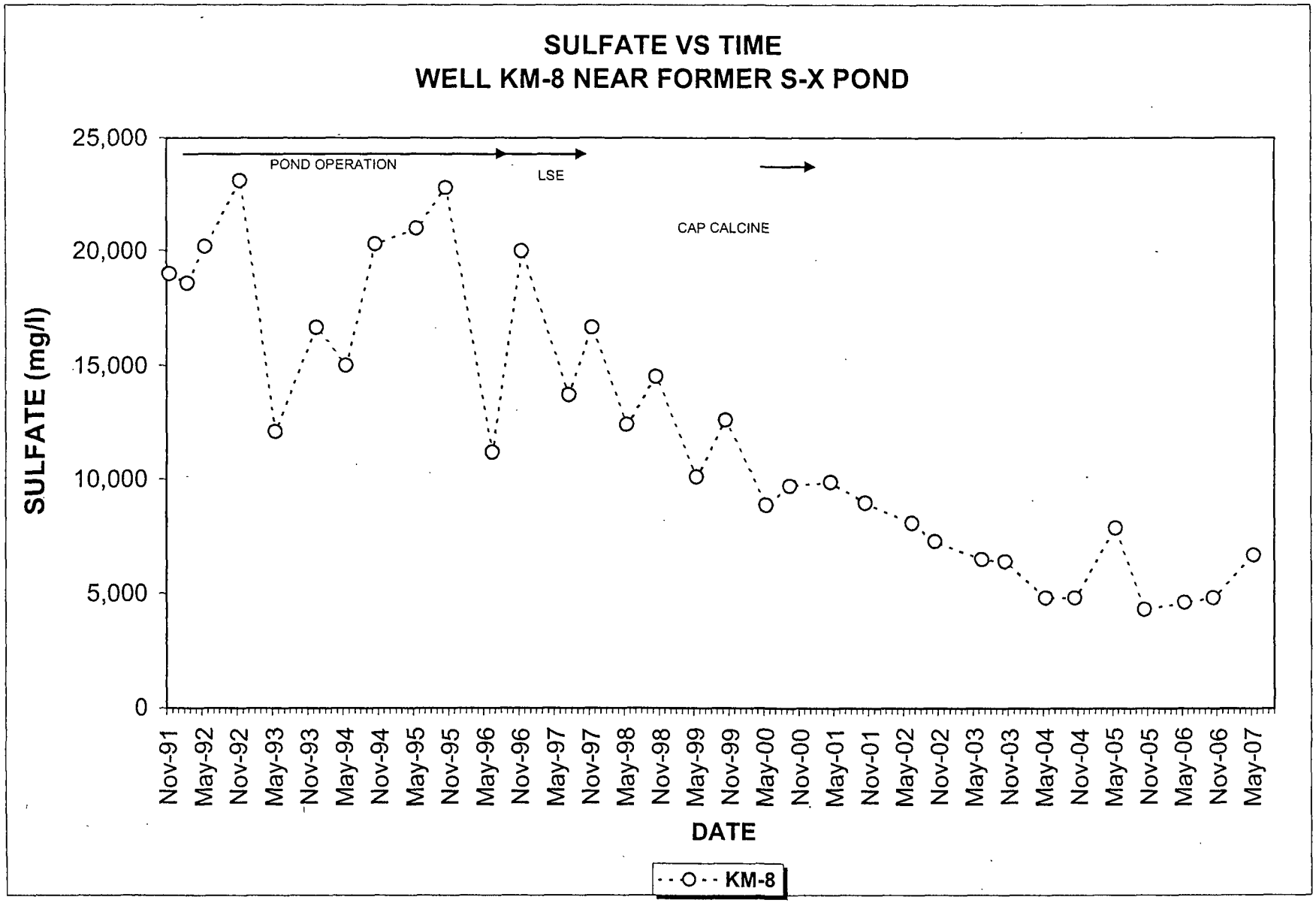
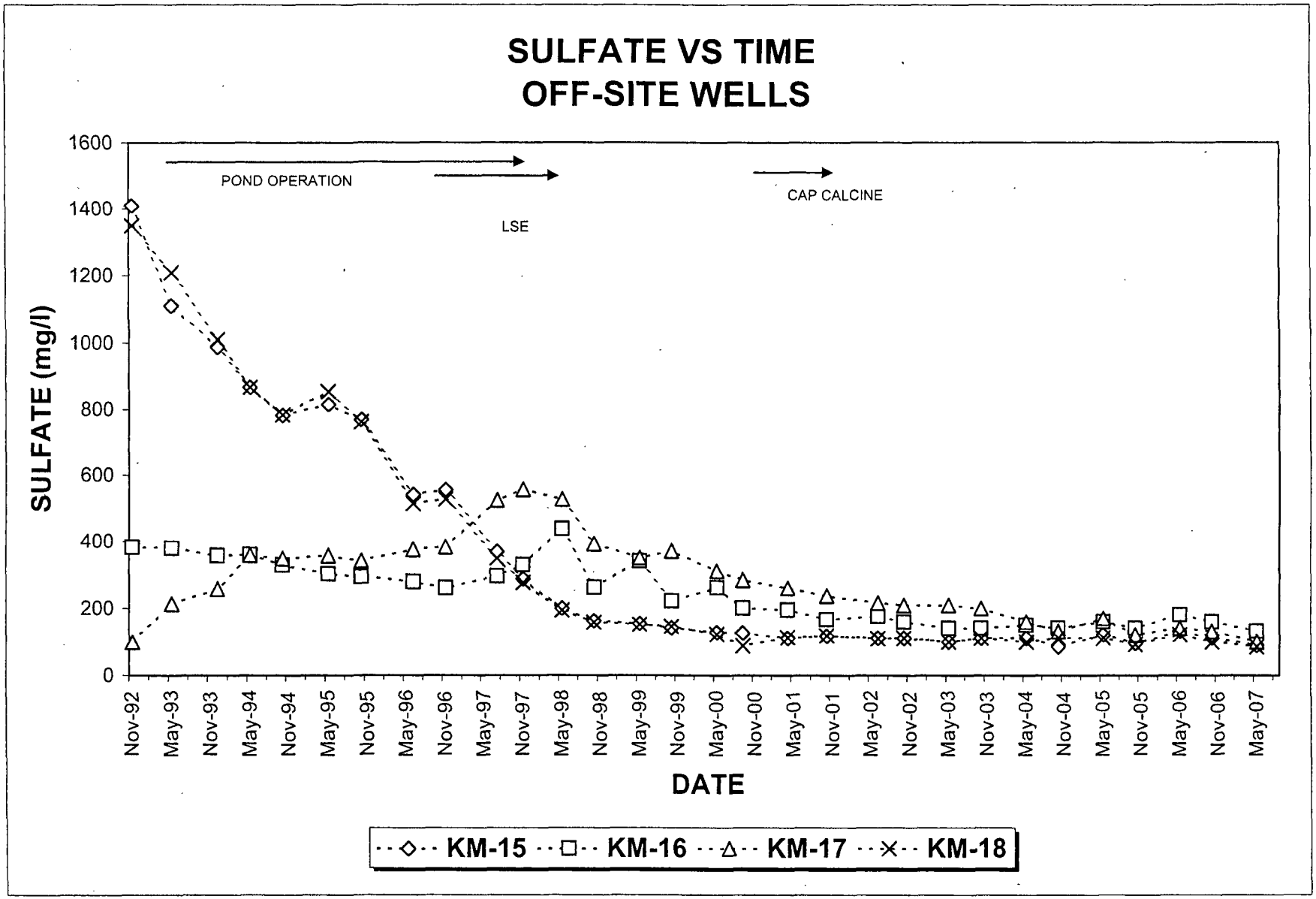
KM-5
KM-6
KM-7
KM-9
KM-12
KM-13
KM-19


SULFATE VS TIME
WELL KM-8 NEAR FORMER S-X POND
POND OPERATION
LSE
CAP CALCINE
SULFATE (mg/l)
25,000
20,000
15,000
10,000
5,000
0
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-8


SULFATE VS TIME
OFF-SITE WELLS
POND OPERATION
LSE
CAP CALCINE
SULFATE (mg/l)
1600
1400
1200
1000
800
600
400
200
0
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
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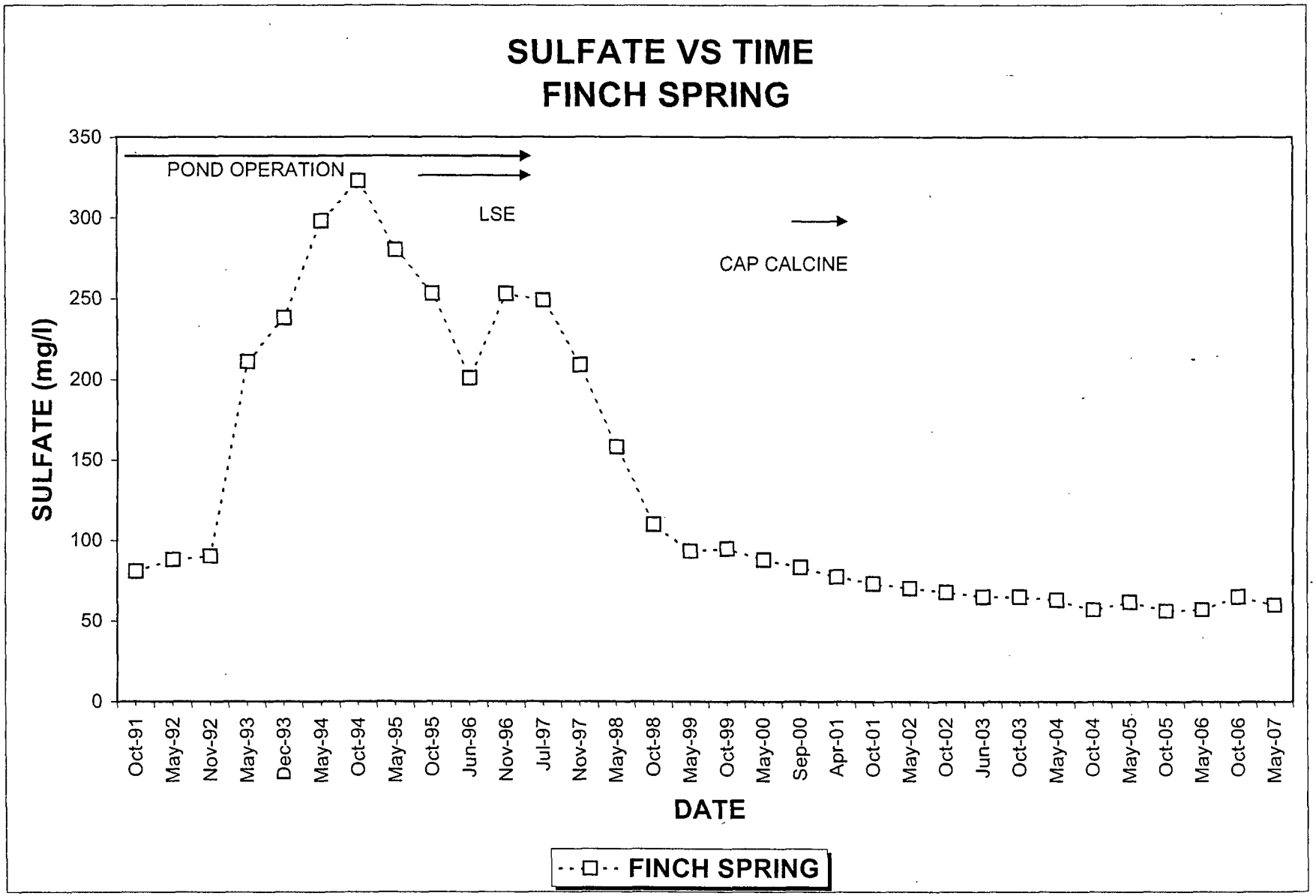
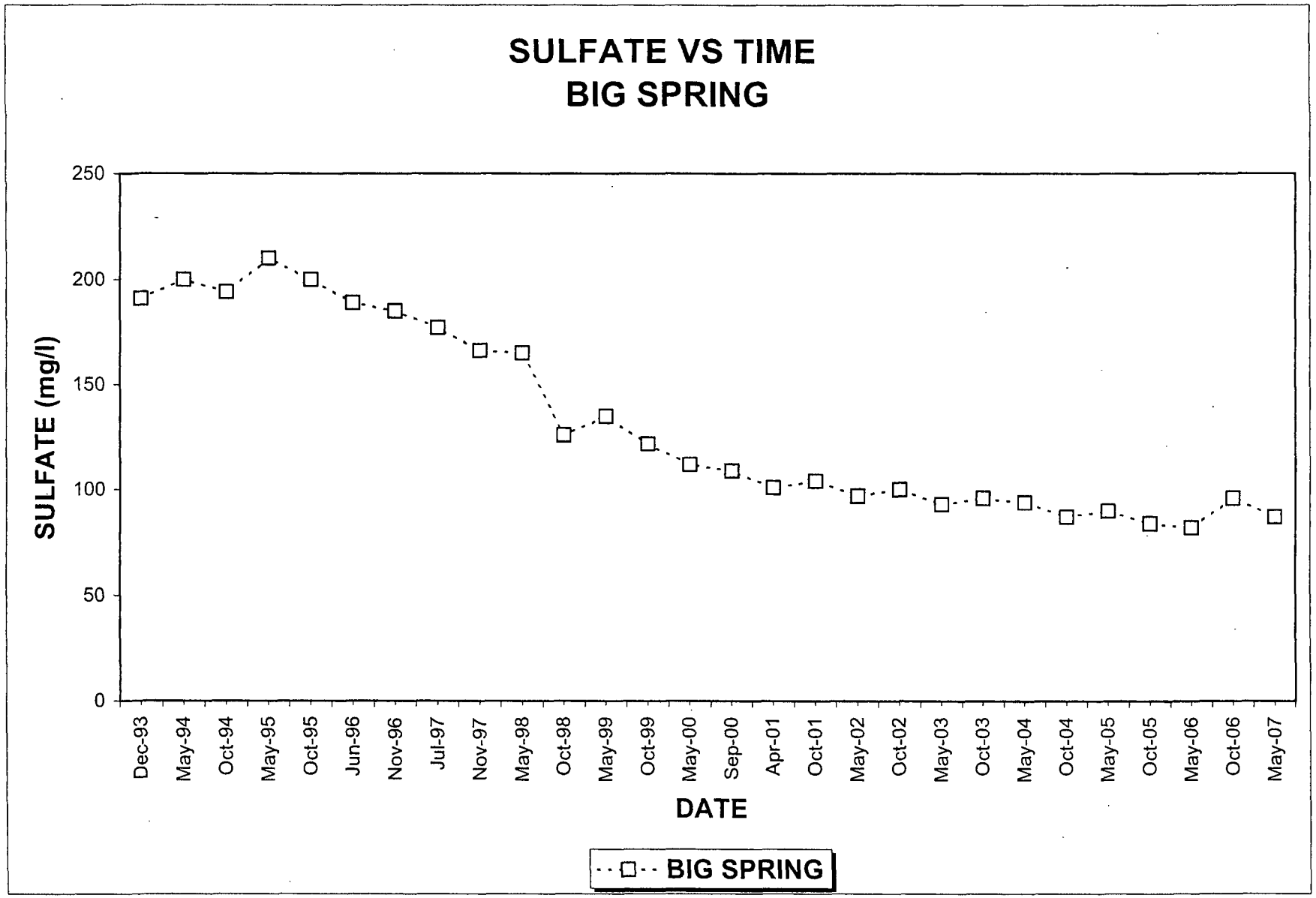
KM-15
KM-16
KM-17
KM-18


SULFATE VS TIME
FINCH SPRING
SULFATE (mg/l)
350
300
250
200
150
100
50
0
POND OPERATION
LSE
CAP CALCINE
Oct-91
May-92
Nov-92
May-93
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
Jun-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
FINCH SPRING


SULFATE VS TIME
BIG SPRING
SULFATE (mg/l)
250
200
150
100
50
0
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
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May-05
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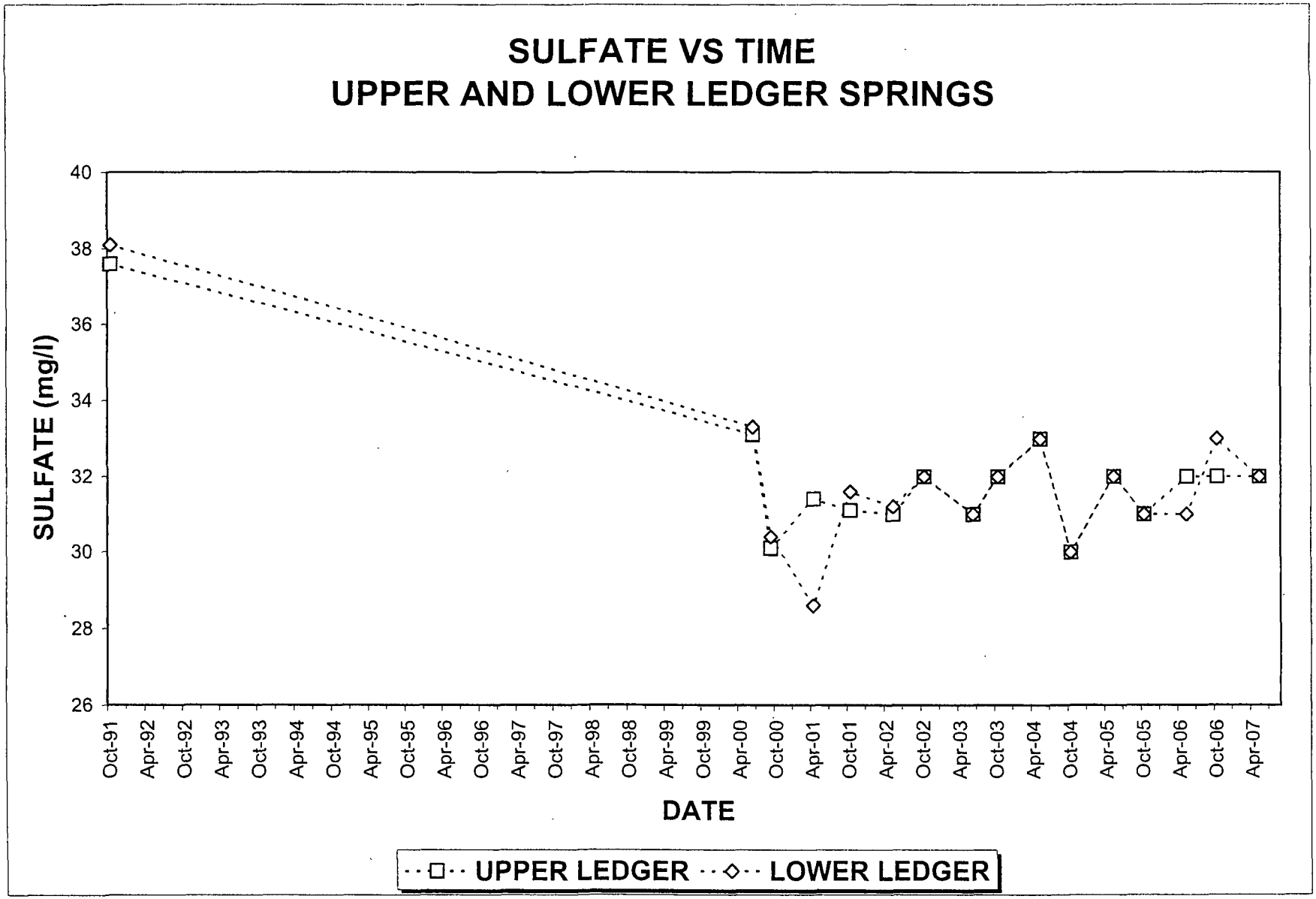
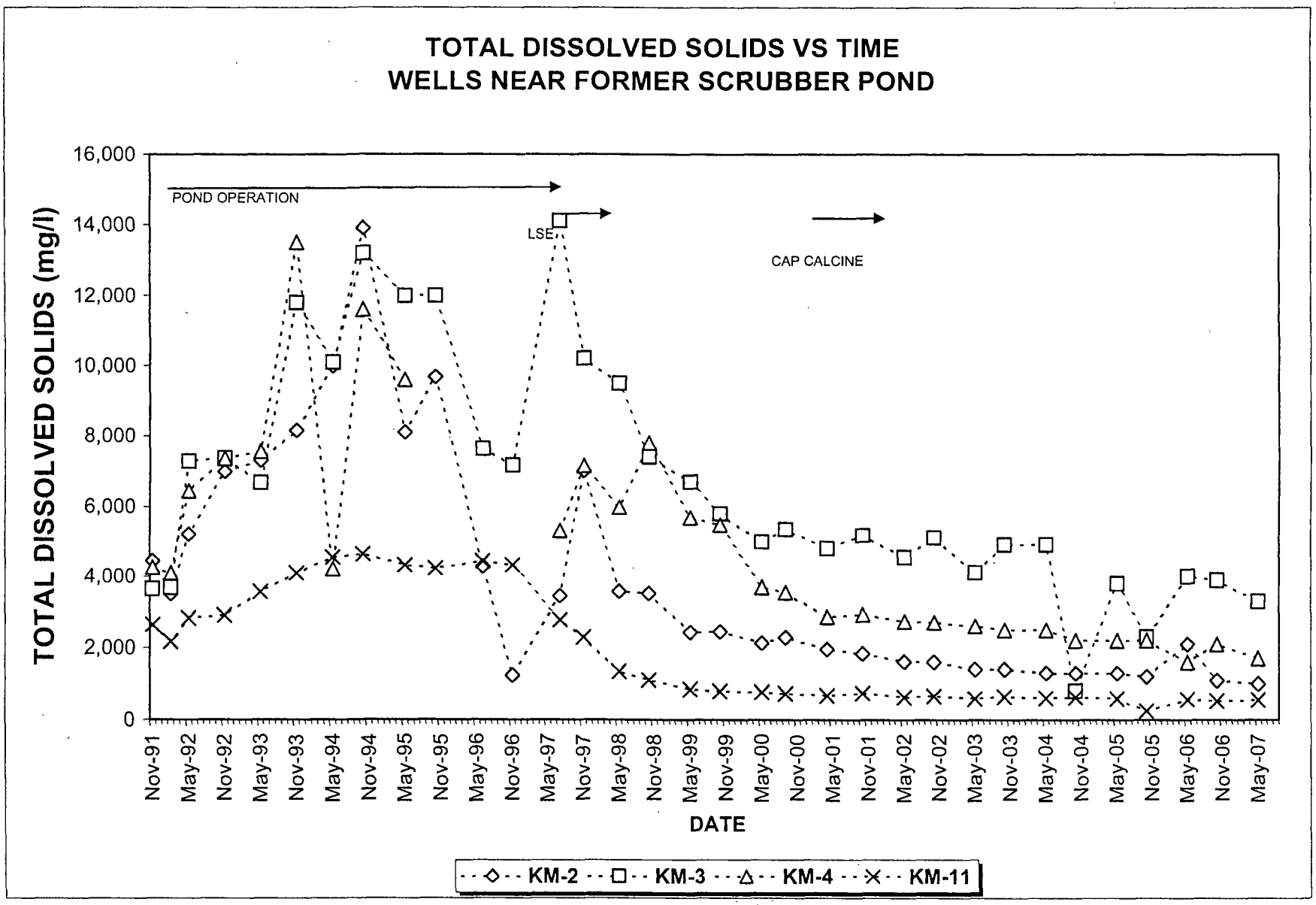
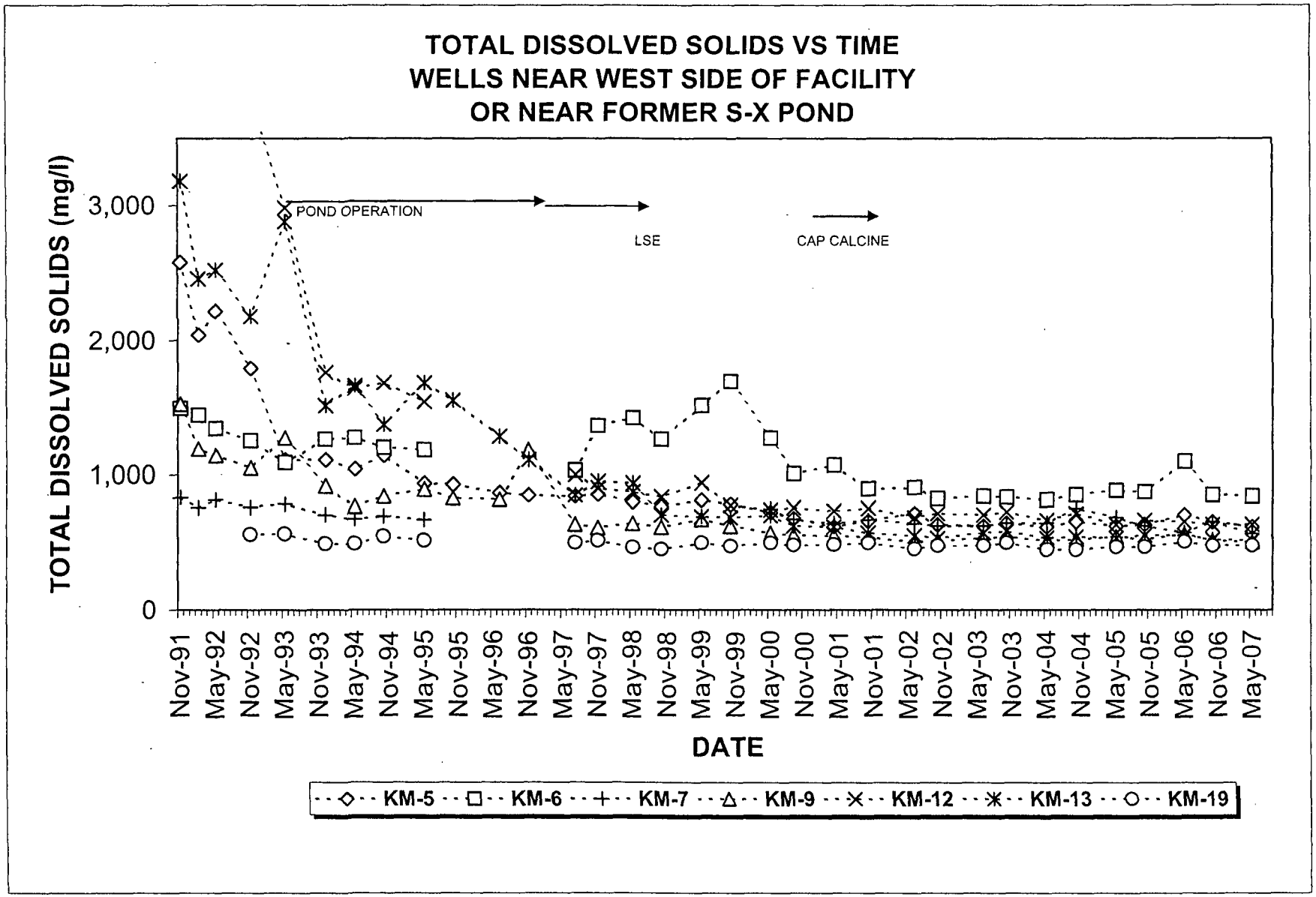
May-06
Oct-06
May-07
DATE
BIG SPRING


SULFATE VS TIME
UPPER AND LOWER LEDGER SPRINGS
SULFATE (mg/l)
40
38
36
34
32
30
28
26
Oct-91
Apr-92
Oct-92
Apr-93
Oct-93
Apr-94
Oct-94
Apr-95
Oct-95
Apr-96
Oct-96
Apr-97
Oct-97
Apr-98
Oct-98
Apr-99
Oct-99
Apr-00
Oct-00
Apr-01
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03
Apr-04
Oct-04
Apr-05
Oct-05
Apr-06
Oct-06
Apr-07
DATE
UPPER LEDGER
LOWER LEDGER


TOTAL DISSOLVED SOLIDS VS TIME
WELLS NEAR FORMER SCRUBBER POND
TOTAL DISSOLVED SOLIDS (mg/l)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-2
KM-3
KM-4
KM-11


TOTAL DISSOLVED SOLIDS VS TIME
WELLS NEAR WEST SIDE OF FACILITY
OR NEAR FORMER S-X POND
TOTAL DISSOLVED SOLIDS (mg/l)
3,000
2,000
1,000
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
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May-07
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KM-5
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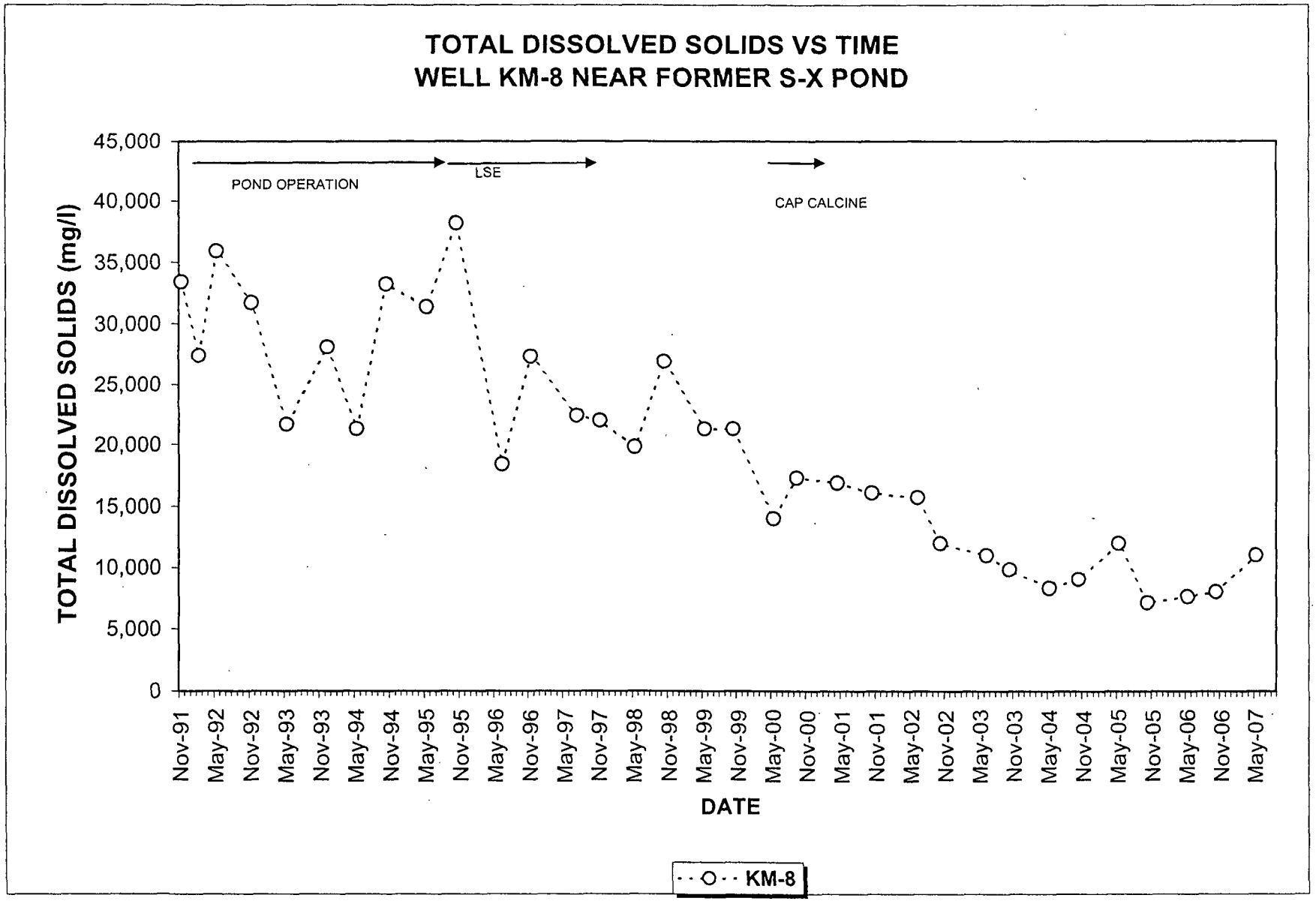
KM-9
KM-12
KM-13
KM-19


TOTAL DISSOLVED SOLIDS VS TIME
WELL KM-8 NEAR FORMER S-X POND
POND OPERATION
LSE
CAP CALCINE
TOTAL DISSOLVED SOLIDS (mg/l)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
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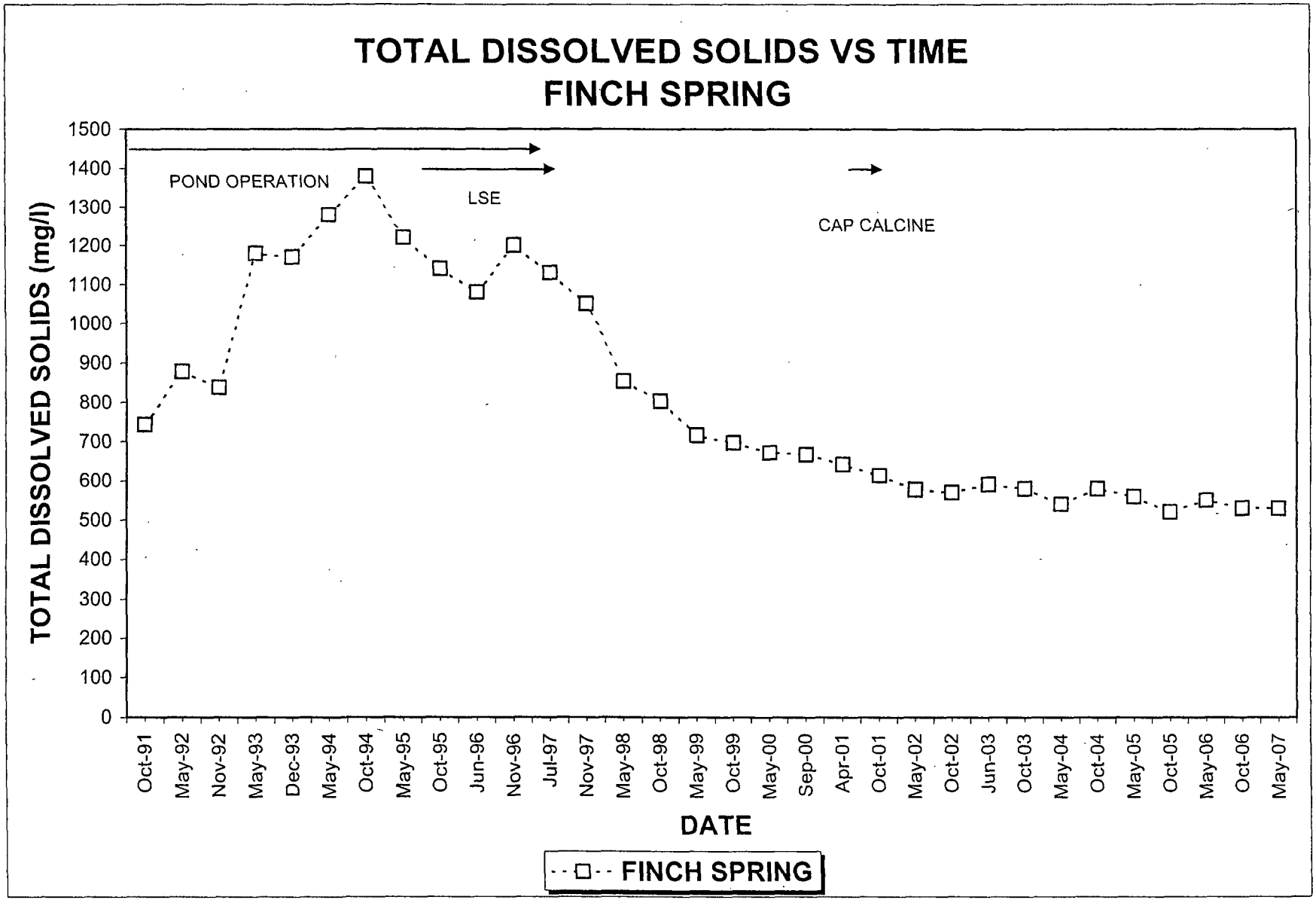
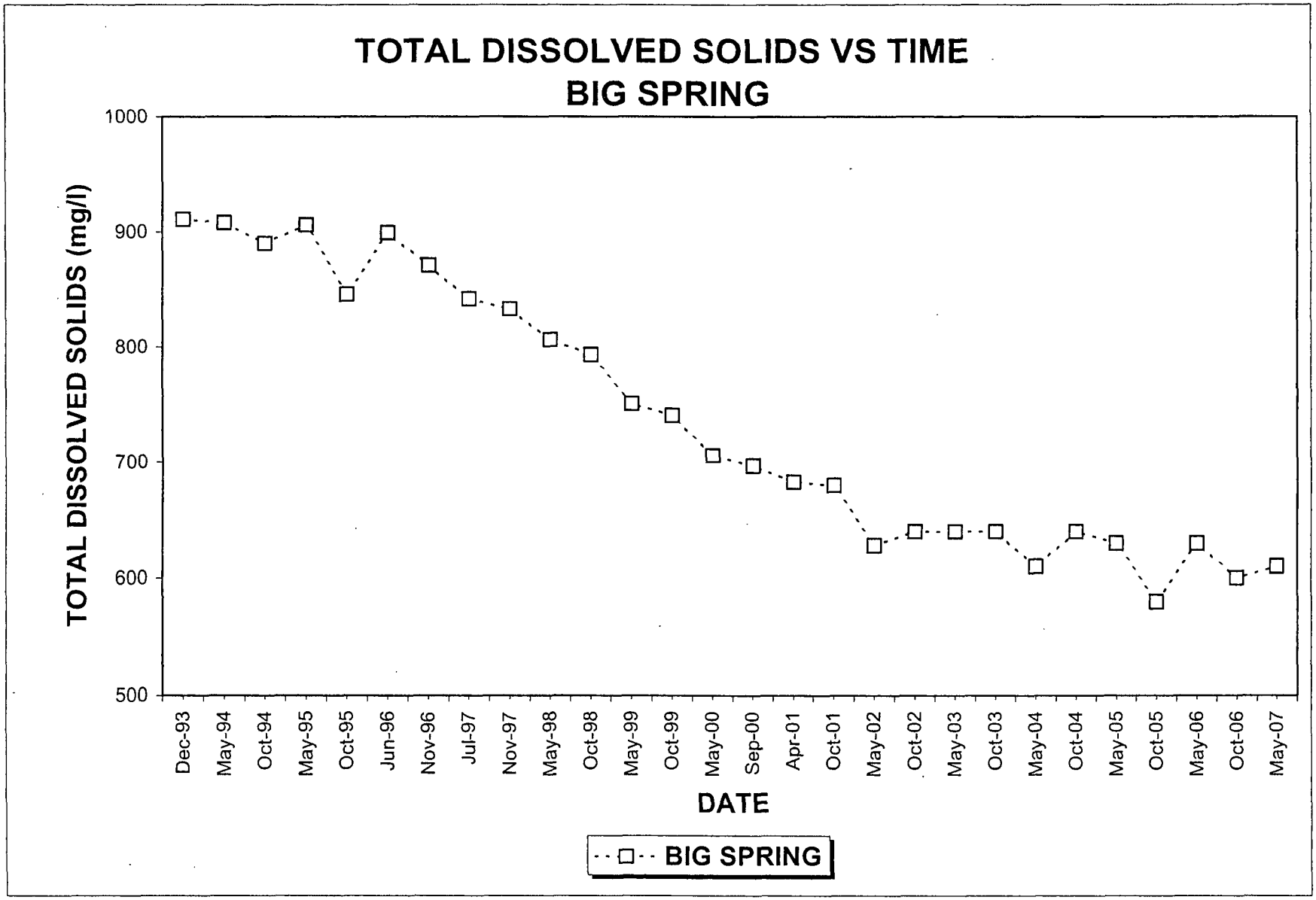
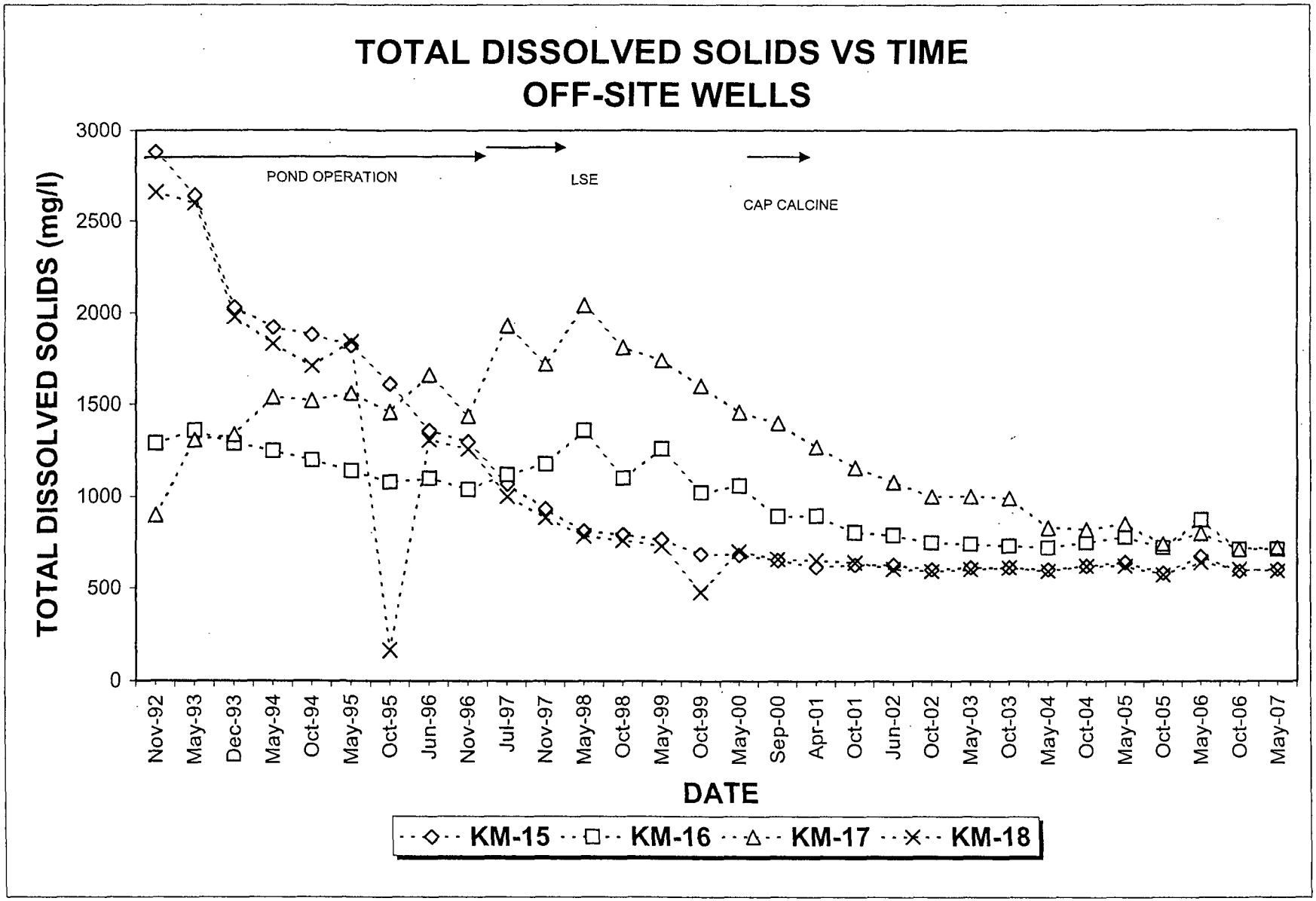
May-06
Nov-06
May-07
DATE
KM-8


TOTAL DISSOLVED SOLIDS VS TIME
FINCH SPRING
TOTAL DISSOLVED SOLIDS (mg/l)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
POND OPERATION
LSE
CAP CALCINE
Oct-91
May-92
Nov-92
May-93
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
Jun-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
FINCH SPRING


TOTAL DISSOLVED SOLIDS VS TIME
BIG SPRING
TOTAL DISSOLVED SOLIDS (mg/l)
1000
900
800
700
600
500
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
May-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
BIG SPRING


TOTAL DISSOLVED SOLIDS VS TIME
OFF-SITE WELLS
TOTAL DISSOLVED SOLIDS (mg/l)
3000
2500
2000
1500
1000
500
0
POND OPERATION
LSE
CAP CALCINE
Nov-92
May-93
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
Jun-02
Oct-02
May-03
Oct-03
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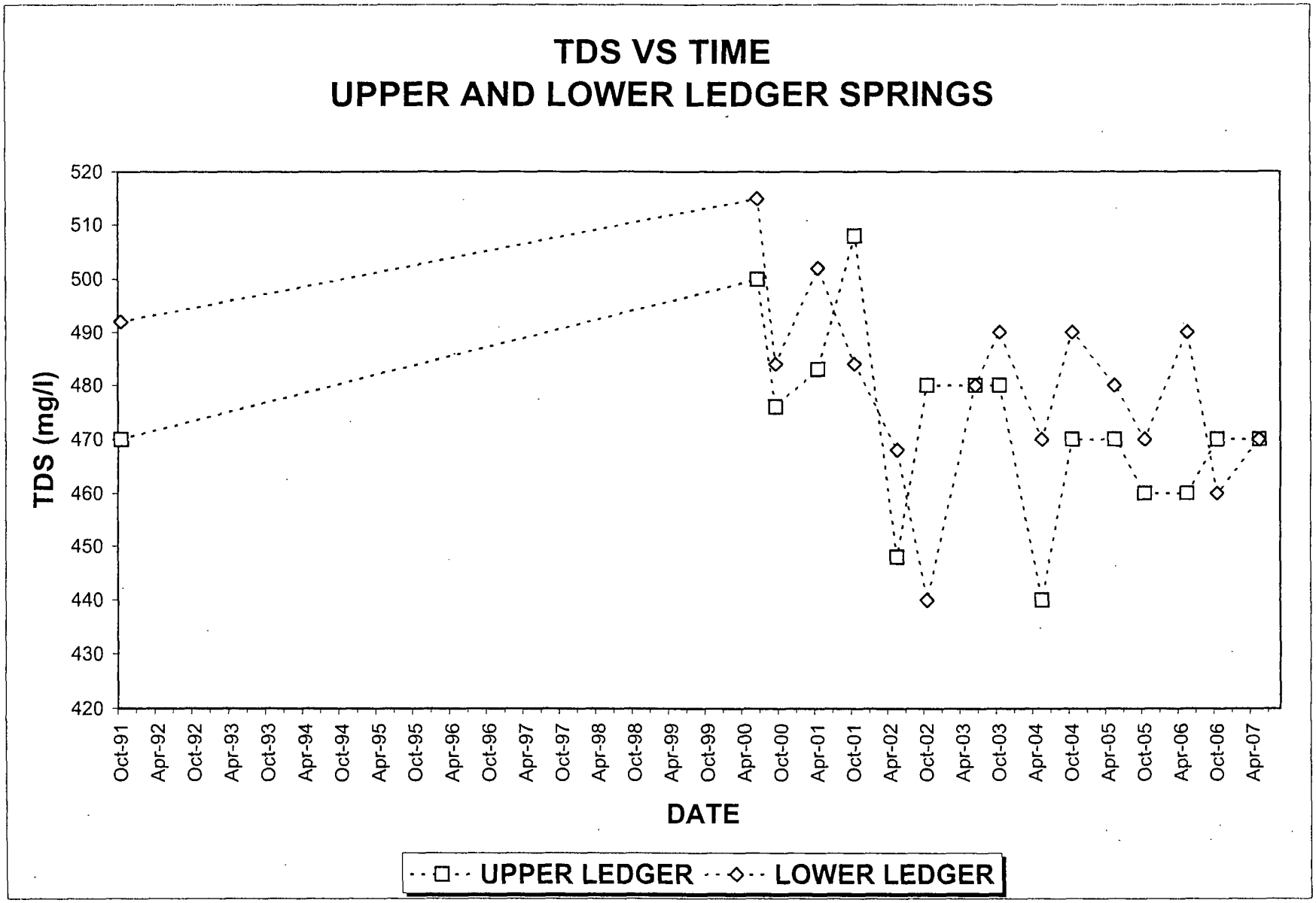
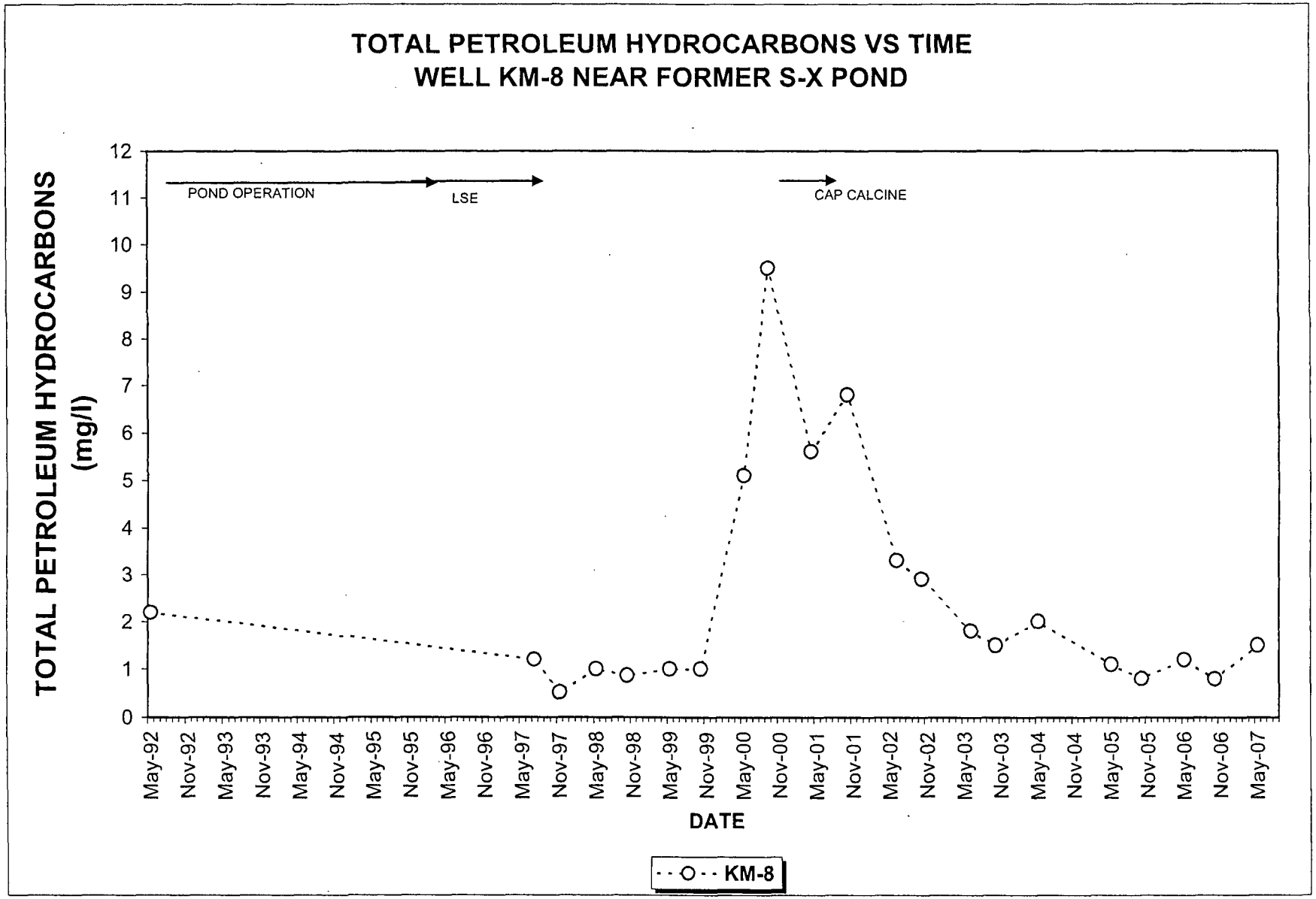
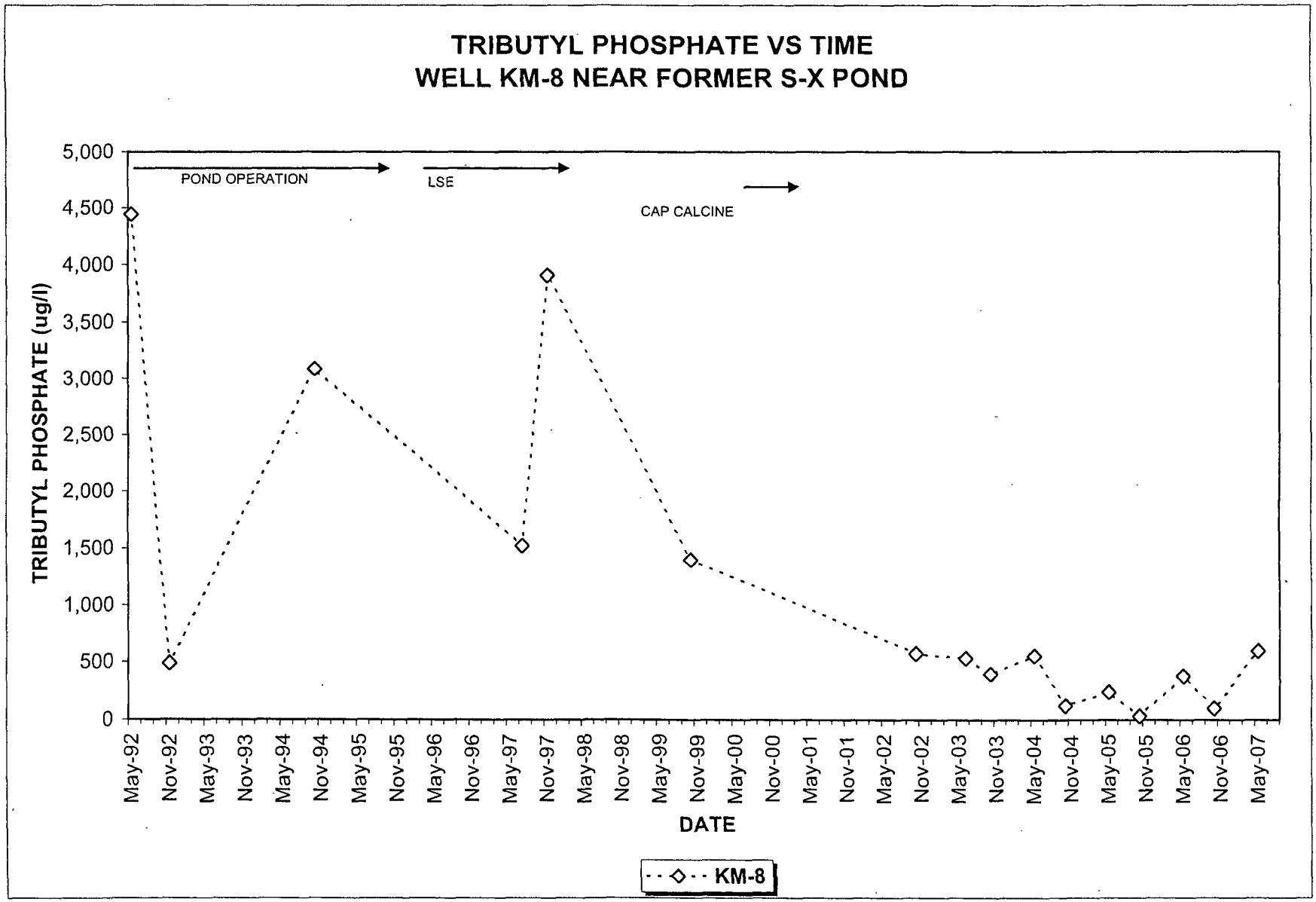
Oct-05
May-06
Oct-06
May-07
DATE
KM-15
KM-16
KM-17
KM-18

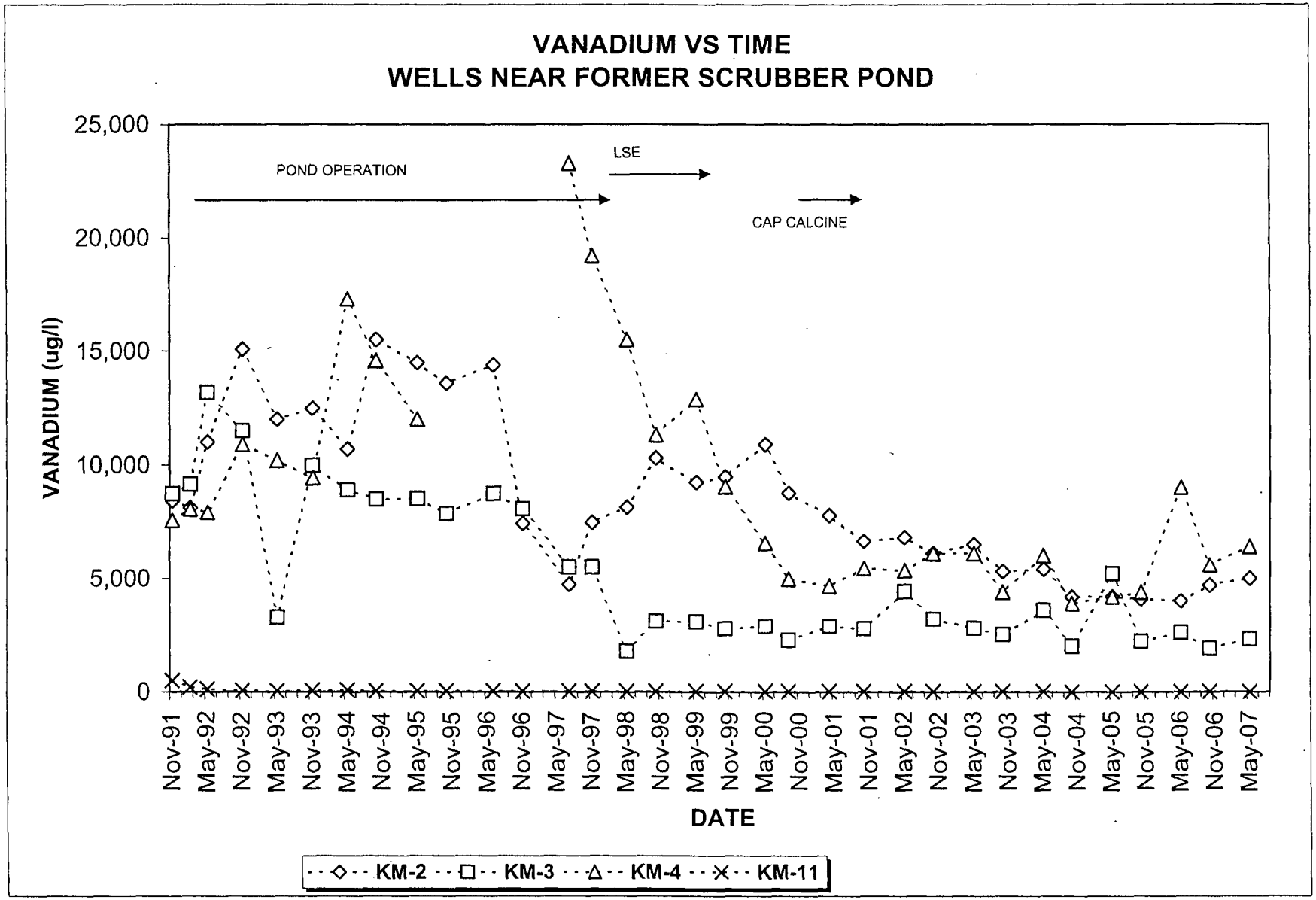

TDS VS TIME
UPPER AND LOWER LEDGER SPRINGS
TDS (mg/l)
520
510
500
490
480
470
460
450
440
430
420
Oct-91
Apr-92
Oct-92
Apr-93
Oct-93
Apr-94
Oct-94
Apr-95
Oct-95
Apr-96
Oct-96
Apr-97
Oct-97
Apr-98
Oct-98
Apr-99
Oct-99
Apr-00
Oct-00
Apr-01
Oct-01
Apr-02
Oct-02
Apr-03
Oct-03
Apr-04
Oct-04
Apr-05
Oct-05
Apr-06
Oct-06
Apr-07
DATE
UPPER LEDGER
LOWER LEDGER



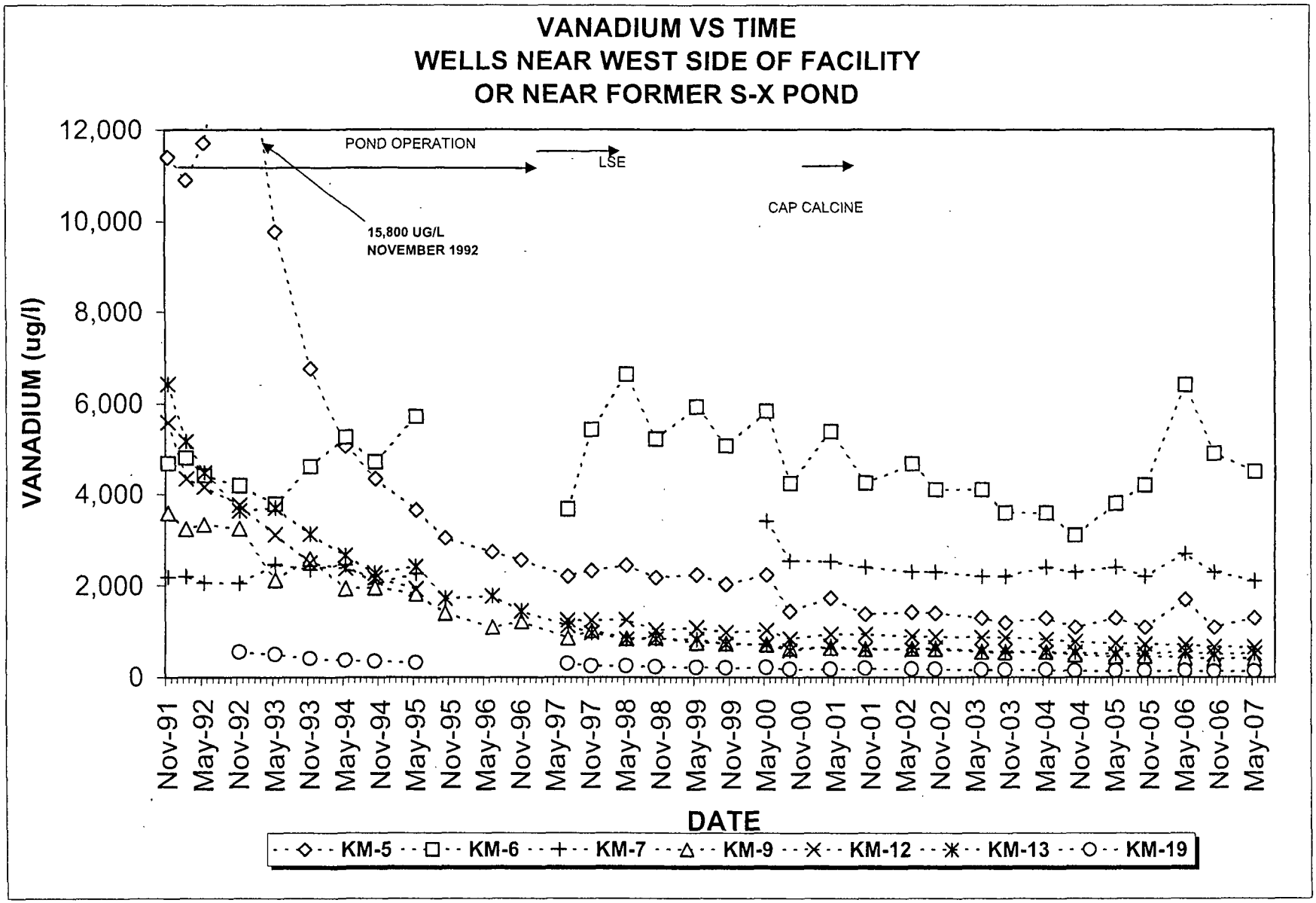
RBC FOR TPH IS 0.73 mg/l
KM-8 IS A POC WELL
1999 VALUES LESS THAN DETECTION



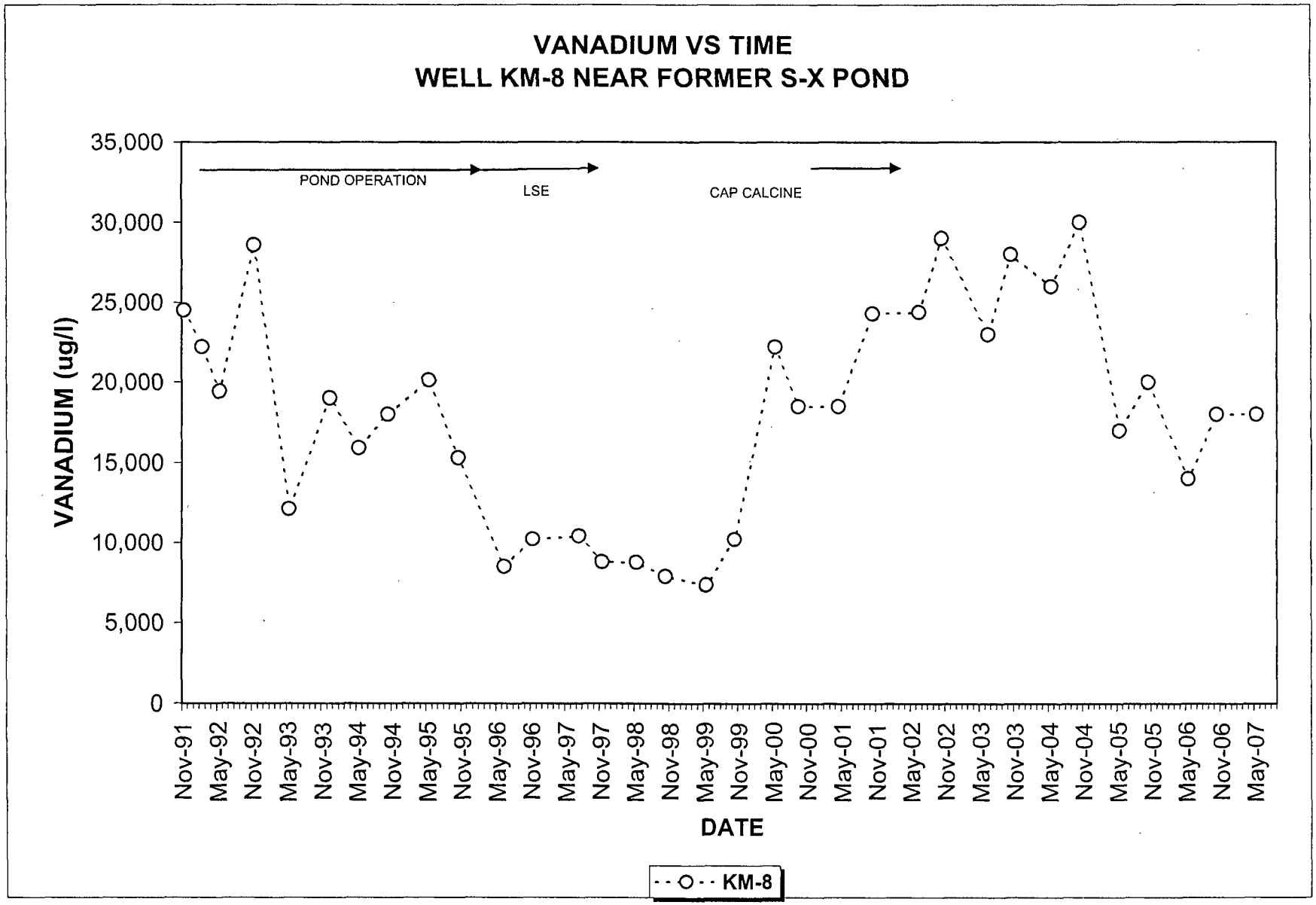
RBC FOR TRIBUTYL PHOSPHATE IS 180 ug/l
KM-8 IS A POC WELL
VALUES ESTIMATED AS DETECTED



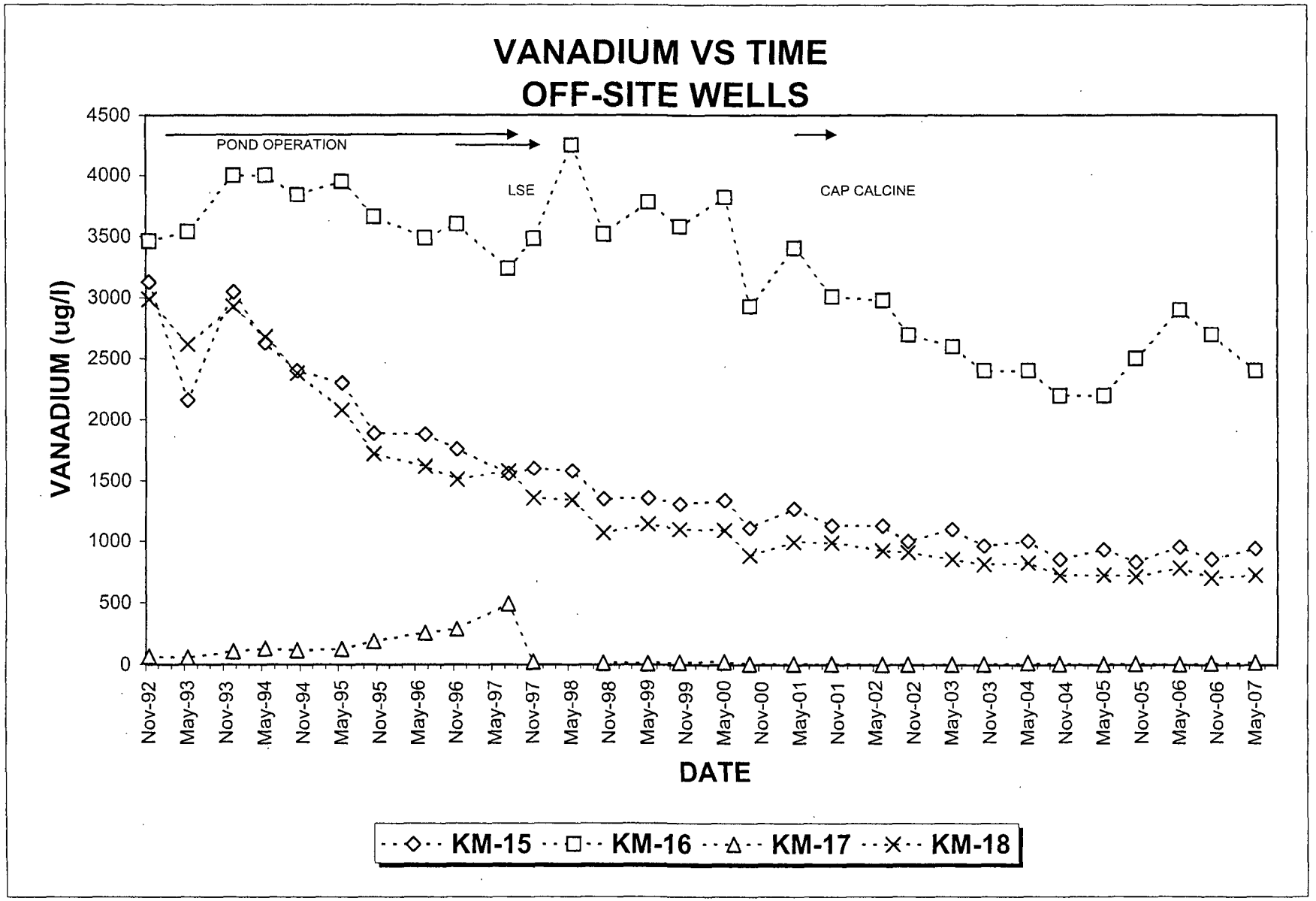
RBC FOR VANADIUM IS 260 ug/l
KM-2, KM-3, KM-11 ARE POC WELLS

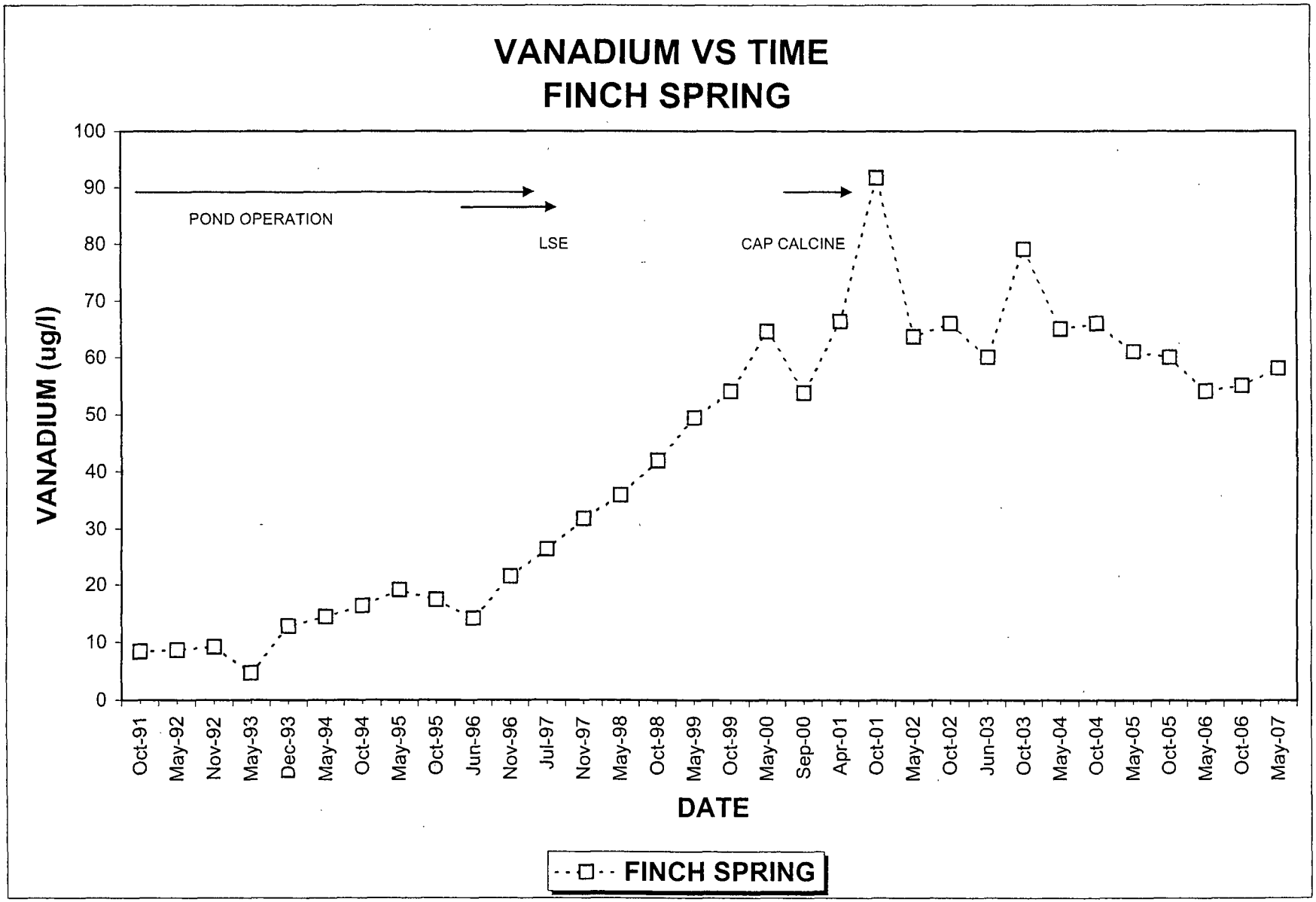


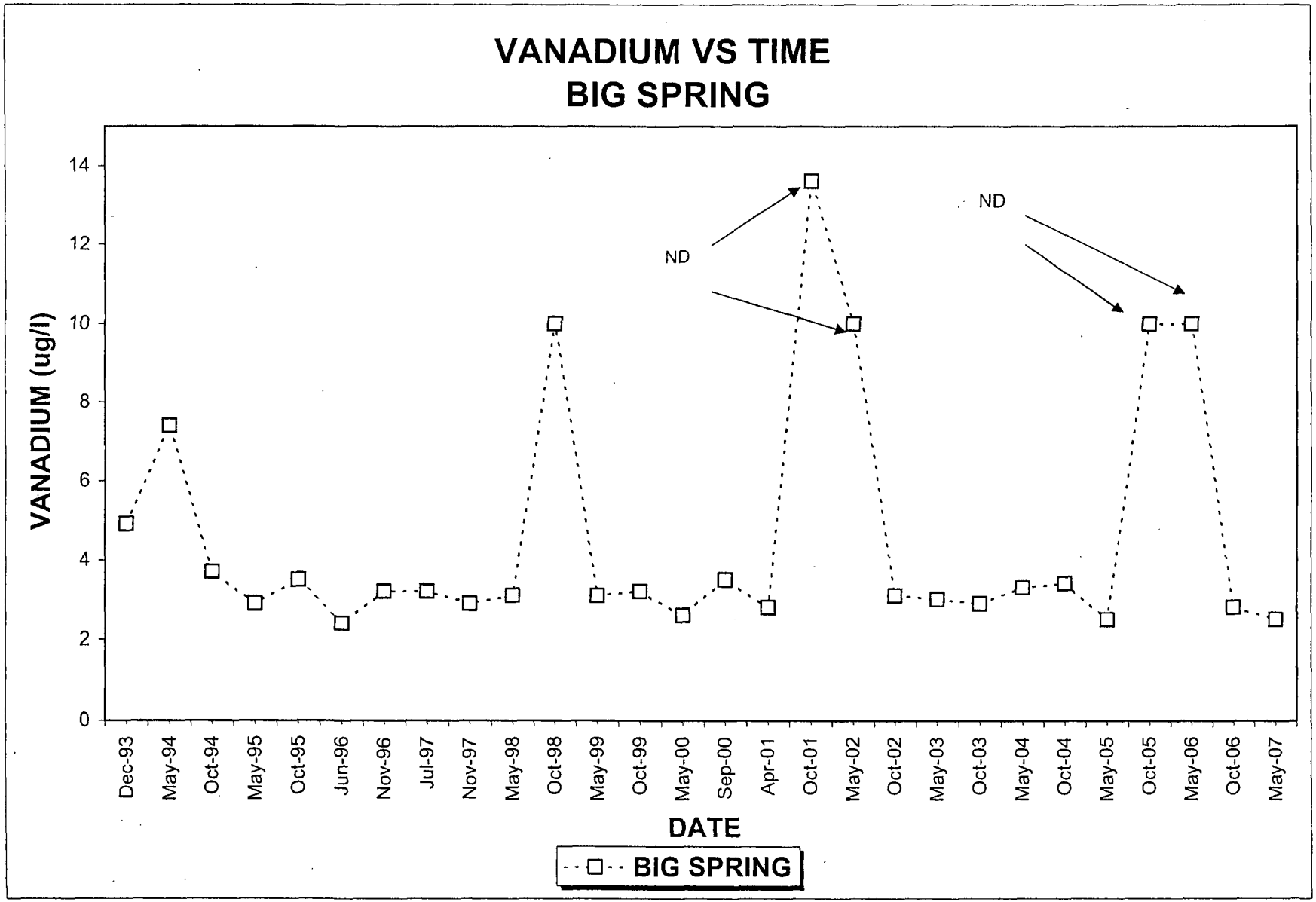
RBC FOR VANADIUM IS 260 ug/l
KM-5, KM-9, KM-12, KM-13, KM-19 ARE POC WELLS



RBC FOR VANADIUM IS 260 ug/l
KM-8 IS A POC WELLS


VANADIUM VS TIME
OFF-SITE WELLS
POND OPERATION
LSE
CAP CALCINE
VANADIUM (ug/l)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-15
KM-16
KM-17
KM-18

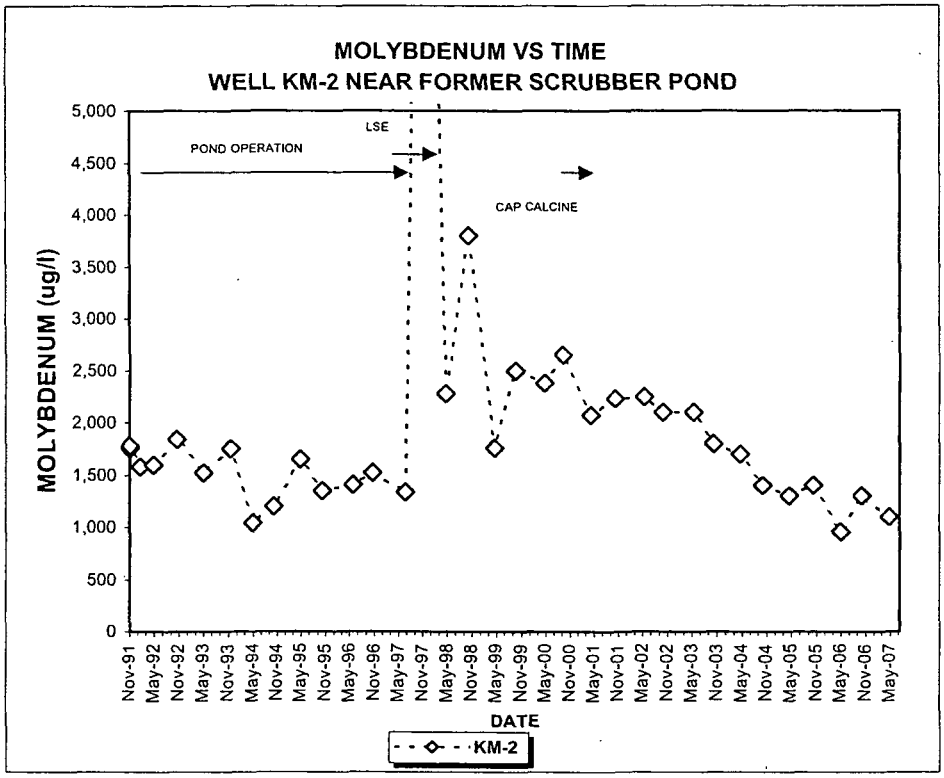

VANADIUM VS TIME
FINCH SPRING
VANADIUM (ug/l)
100
90
80
70
60
50
40
30
20
10
0
POND OPERATION
LSE
CAP CALCINE
Oct-91
May-92
Nov-92
May-93
Dec-93
May-94
Oct-94
May-95
Oct-95
Jun-96
Nov-96
Jul-97
Nov-97
May-98
Oct-98
May-99
Oct-99
May-00
Sep-00
Apr-01
Oct-01
May-02
Oct-02
Jun-03
Oct-03
May-04
Oct-04
May-05
Oct-05
May-06
Oct-06
May-07
DATE
FINCH SPRING

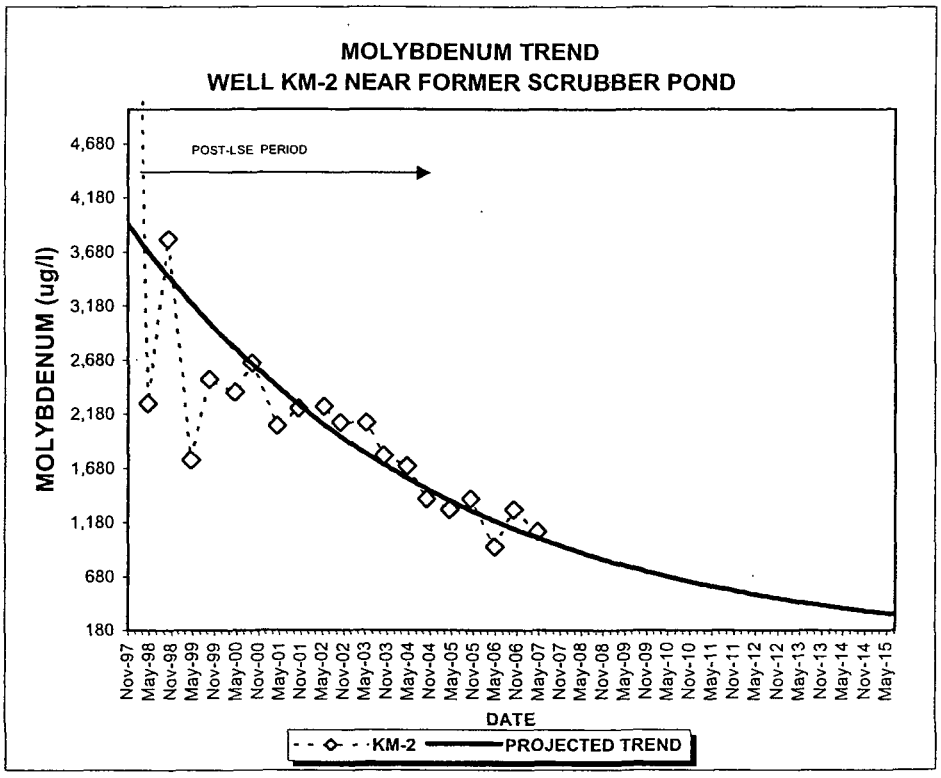


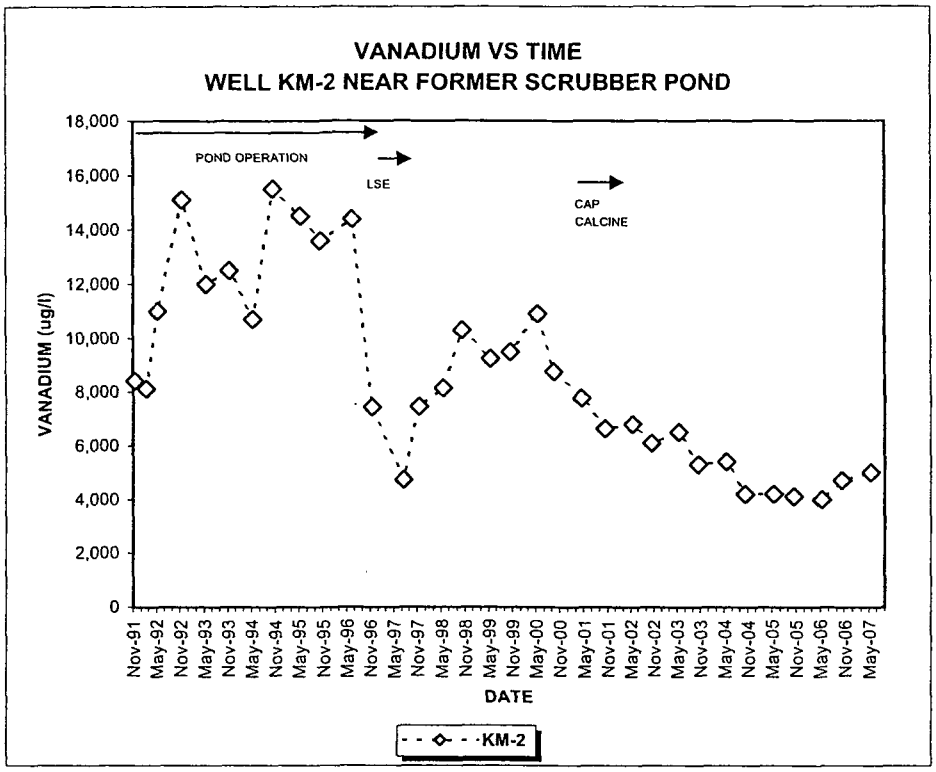
Values less than detection annotated on figure

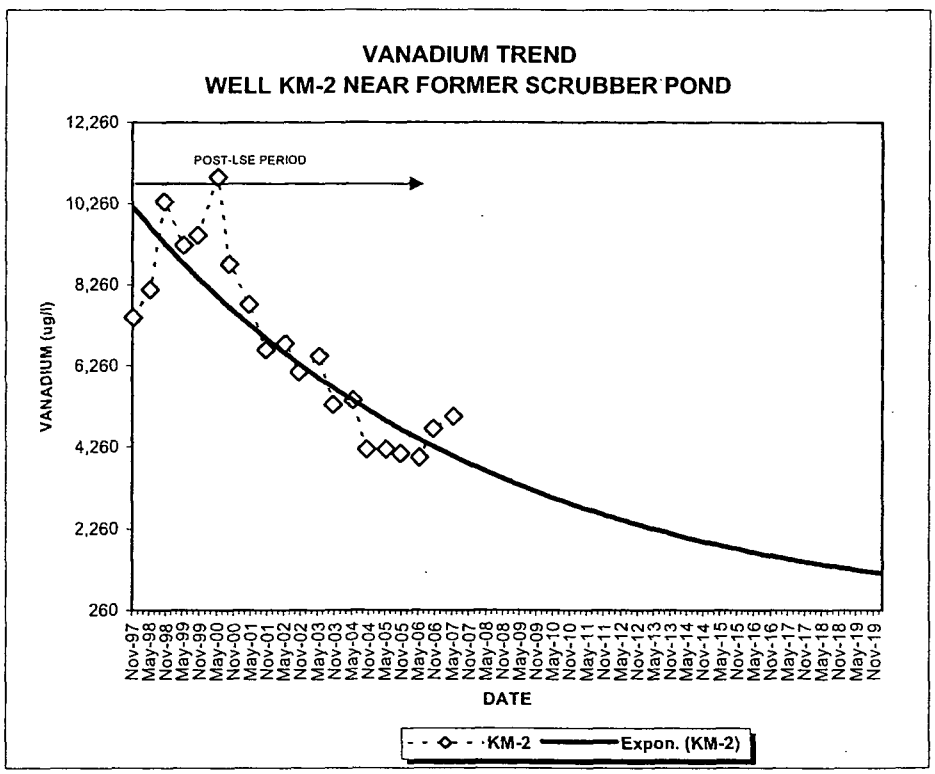
APPENDIX B

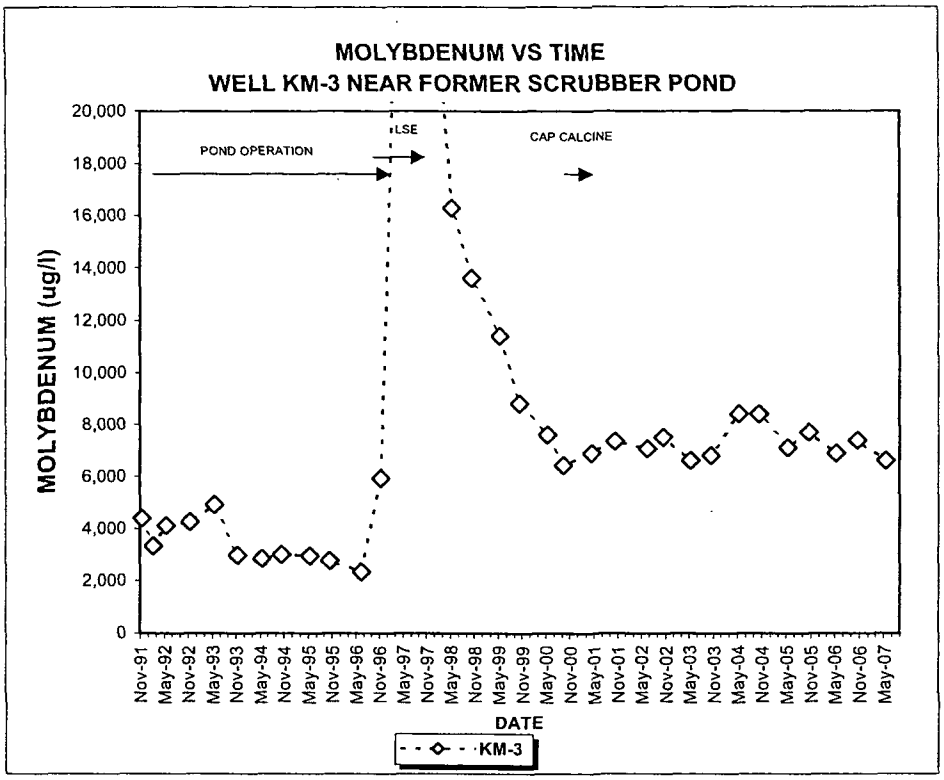
COC CONCENTRATION TRENDS WITH TIME APPENDIX AND PROJECTED TRENDS

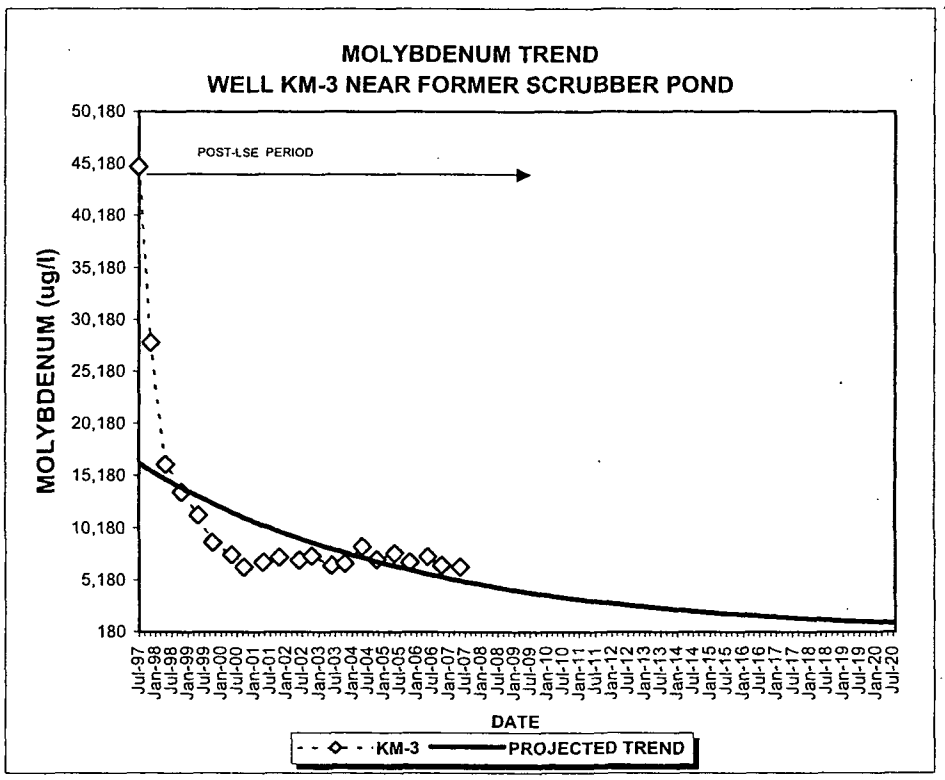

MOLYBDENUM VS TIME
WELL KM-2 NEAR FORMER SCRUBBER POND
MOLYBDENUM (ug/l)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
POND OPERATION
LSE
CAP CALCINE
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-2

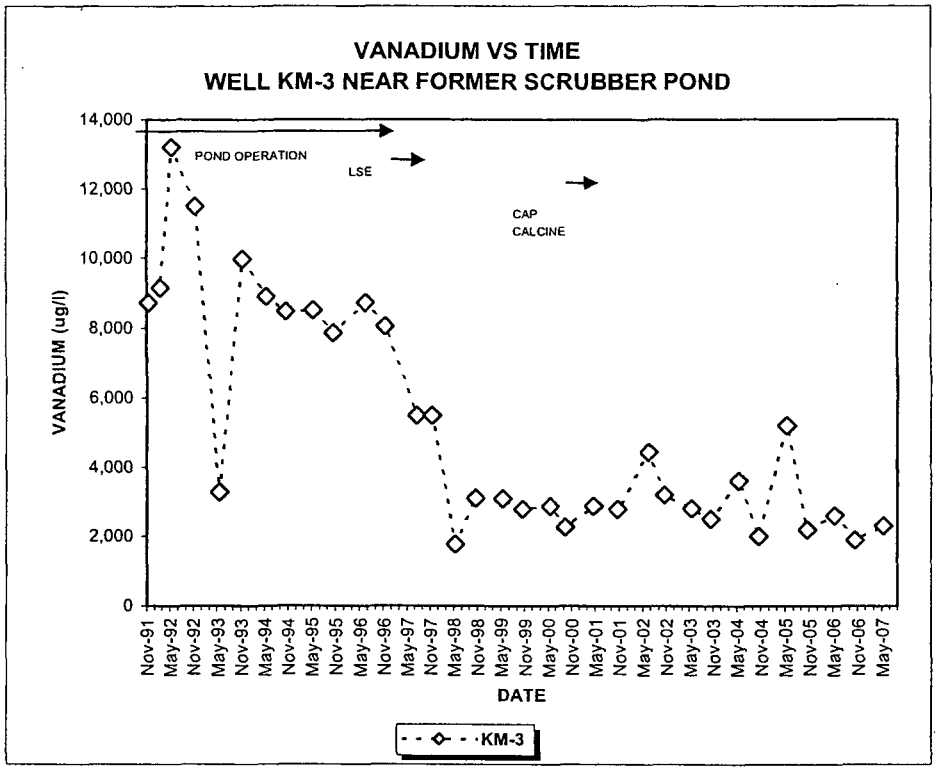

MOLYBDENUM TREND
WELL KM-2 NEAR FORMER SCRUBBER POND
MOLYBDENUM (ug/l)
4,680
4,180
3,680
3,180
2,680
2,180
1,680
1,180
680
180
POST-LSE PERIOD
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
Nov-07
May-08
Nov-08
May-09
Nov-09
May-10
Nov-10
May-11
Nov-11
May-12
Nov-12
May-13
Nov-13
May-14
Nov-14
May-15
DATE
KM-2
PROJECTED TREND

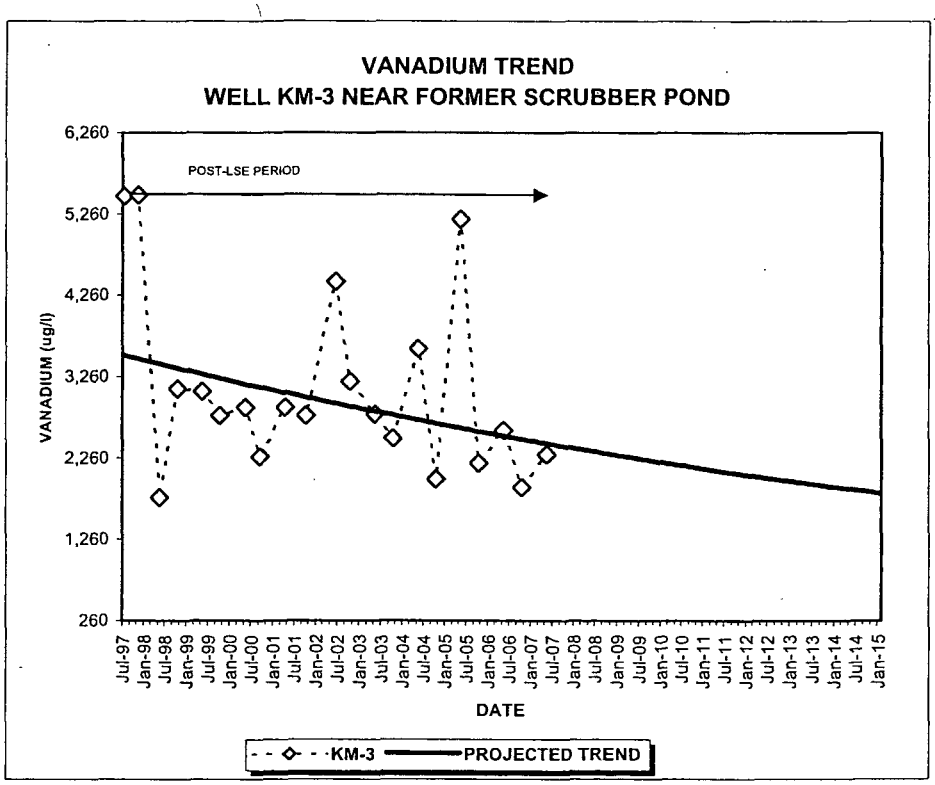

VANADIUM VS TIME
WELL KM-2 NEAR FORMER SCRUBBER POND
POND OPERATION
LSE
CAP
CALCINE
VANADIUM (ug/l)
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
DATE
KM-2


VANADIUM TREND
WELL KM-2 NEAR FORMER SCRUBBER POND
POST-LSE PERIOD
VANADIUM (ug/l)
12,260
10,260
8,260
6,260
4,260
2,260
260
DATE
KM-2
Expon. (KM-2)

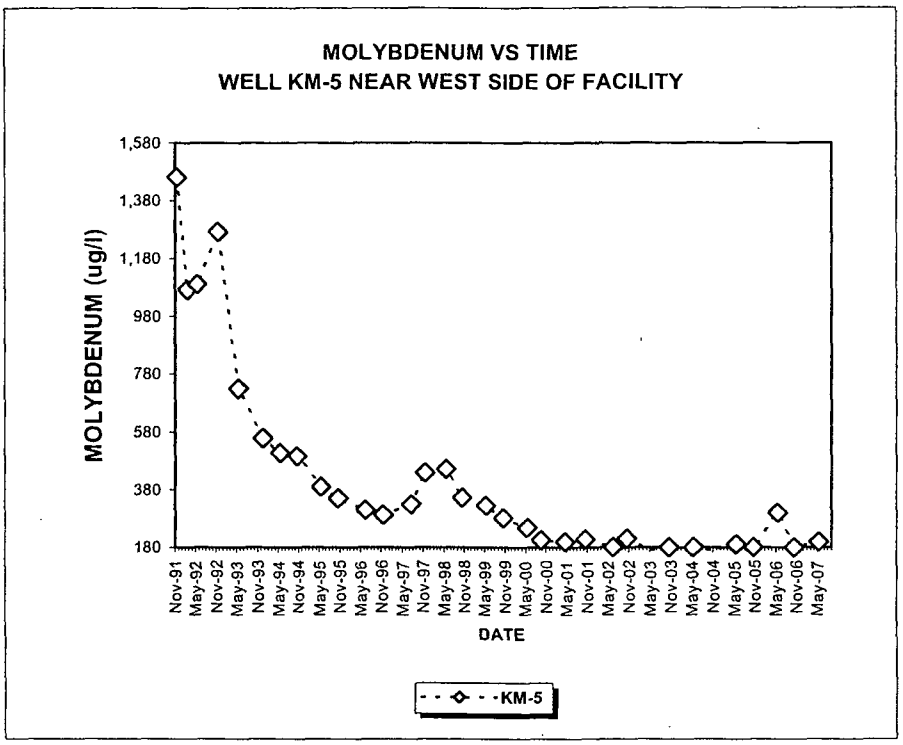

MOLYBDENUM VS TIME
WELL KM-3 NEAR FORMER SCRUBBER POND
POND OPERATION
LSE
CAP CALCINE
MOLYBDENUM (ug/l)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-3

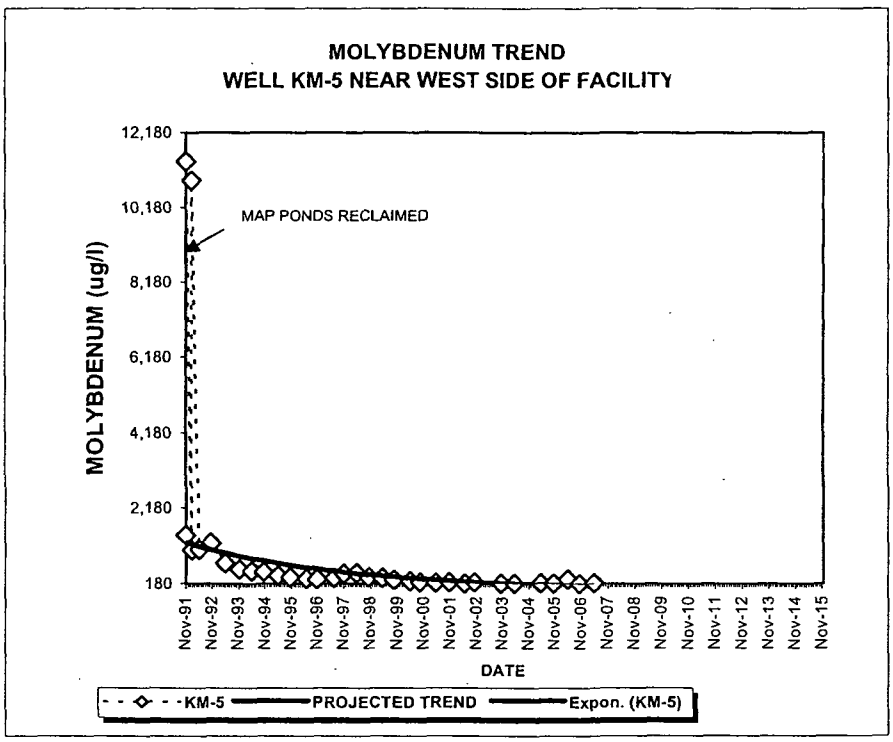

MOLYBDENUM TREND
WELL KM-3 NEAR FORMER SCRUBBER POND
POST-LSE PERIOD
MOLYBDENUM (ug/l)
50,180
45,180
40,180
35,180
30,180
25,180
20,180
15,180
10,180
5,180
180
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
Jan-08
Jul-08
Jan-09
Jul-09
Jan-10
Jul-10
Jan-11
Jul-11
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Jul-20
DATE
KM-3
PROJECTED TREND


VANADIUM VS TIME
WELL KM-3 NEAR FORMER SCRUBBER POND
POND OPERATION
LSE
CAP
CALCINE
VANADIUM (ug/l)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Nov-91
May-92
Nov-92
May-93
Nov-93
May-94
Nov-94
May-95
Nov-95
May-96
Nov-96
May-97
Nov-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Nov-01
May-02
Nov-02
May-03
Nov-03
May-04
Nov-04
May-05
Nov-05
May-06
Nov-06
May-07
DATE
KM-3


VANADIUM TREND
WELL KM-3 NEAR FORMER SCRUBBER POND
POST-LSE PERIOD
VANADIUM (ug/l)
6,260
5,260
4,260
3,260
2,260
1,260
260
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
Jan-08
Jul-08
Jan-09
Jul-09
Jan-10
Jul-10
Jan-11
Jul-11
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
DATE
KM-3
PROJECTED TREND

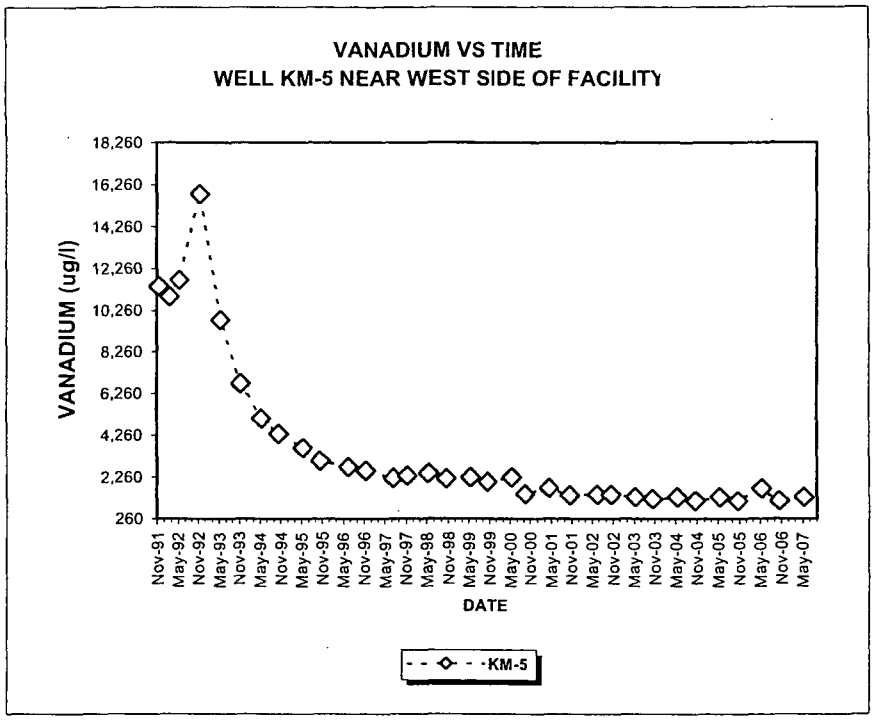
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

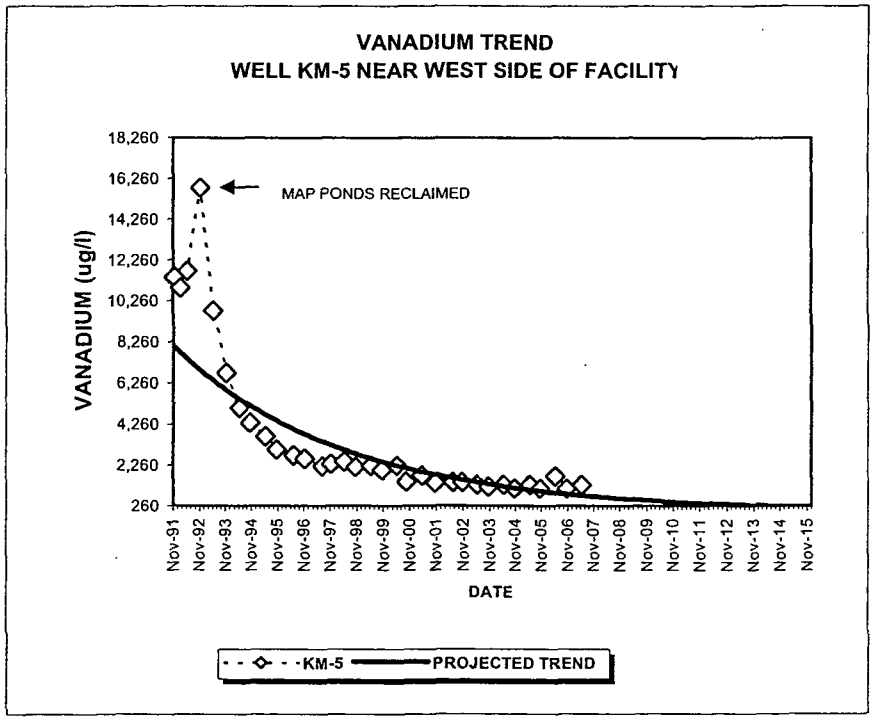




RBC FOR MOLYBDENUM IS 180 UG/L
KM-5 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING LSE

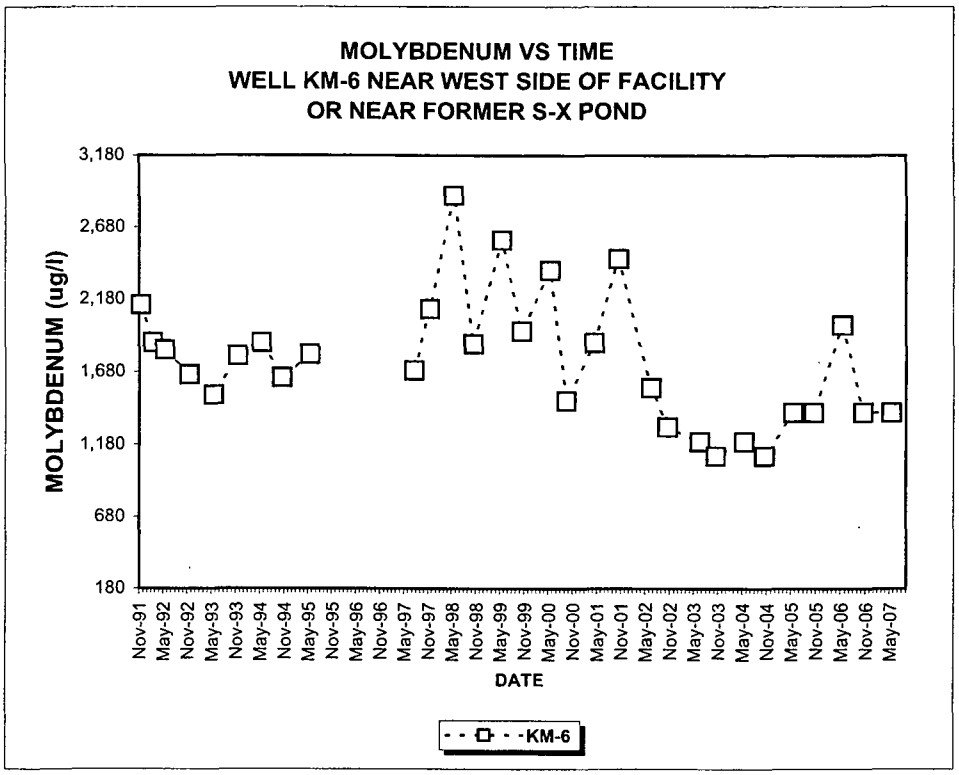
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

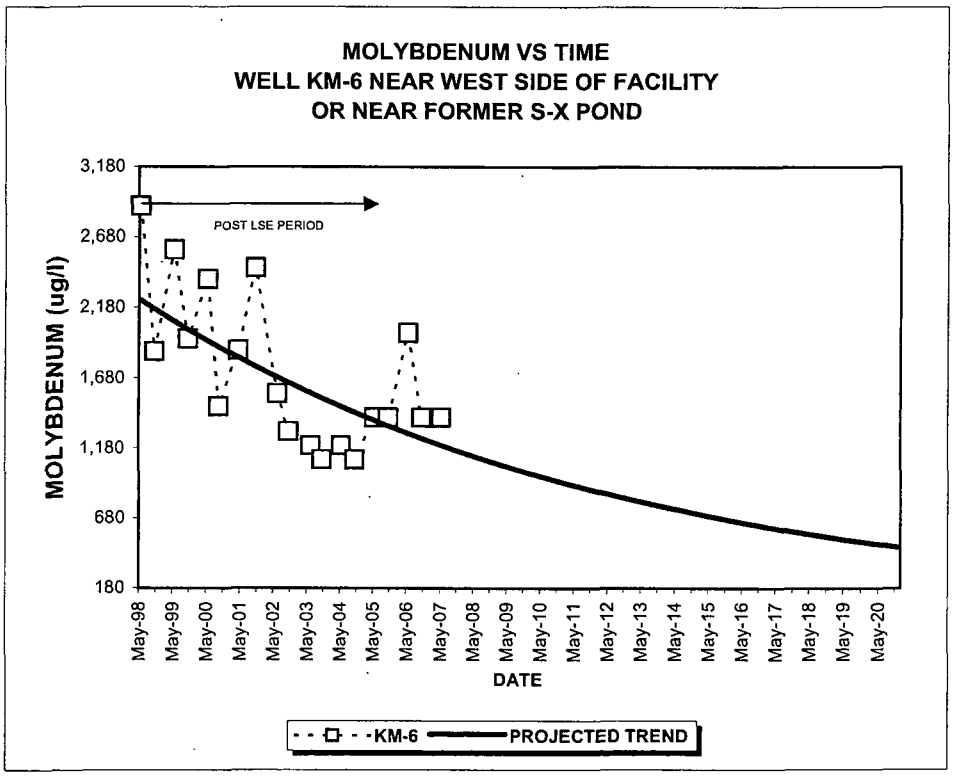




RBC FOR VANADIUM IS 180 UG/L
KM-5 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING LSE

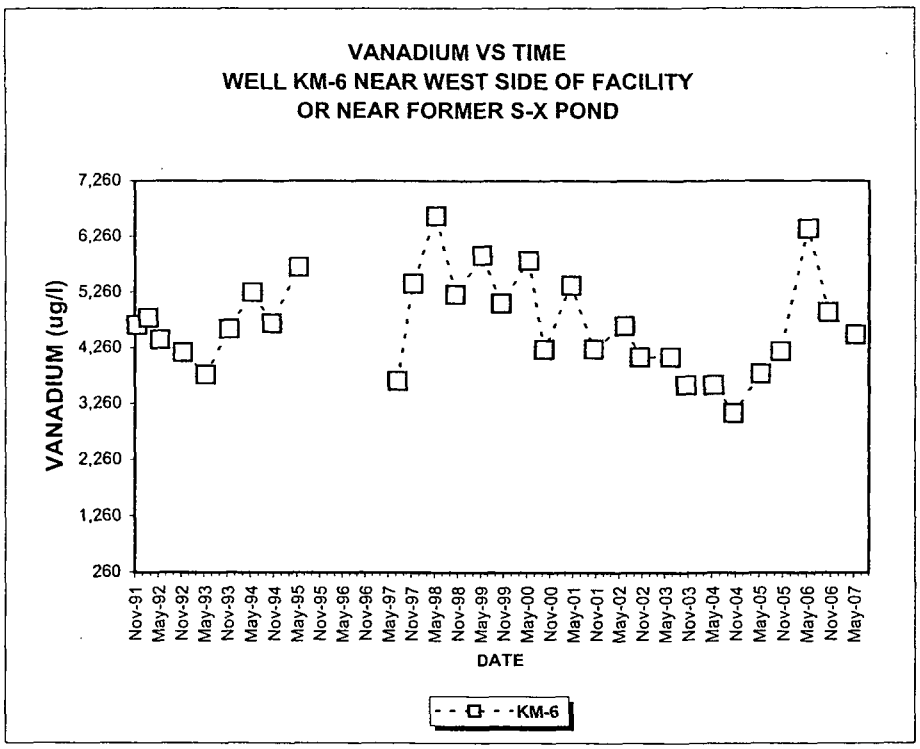
COC CONCENTRATIONS AND PROJECTED TRENDS VERSUS TIME

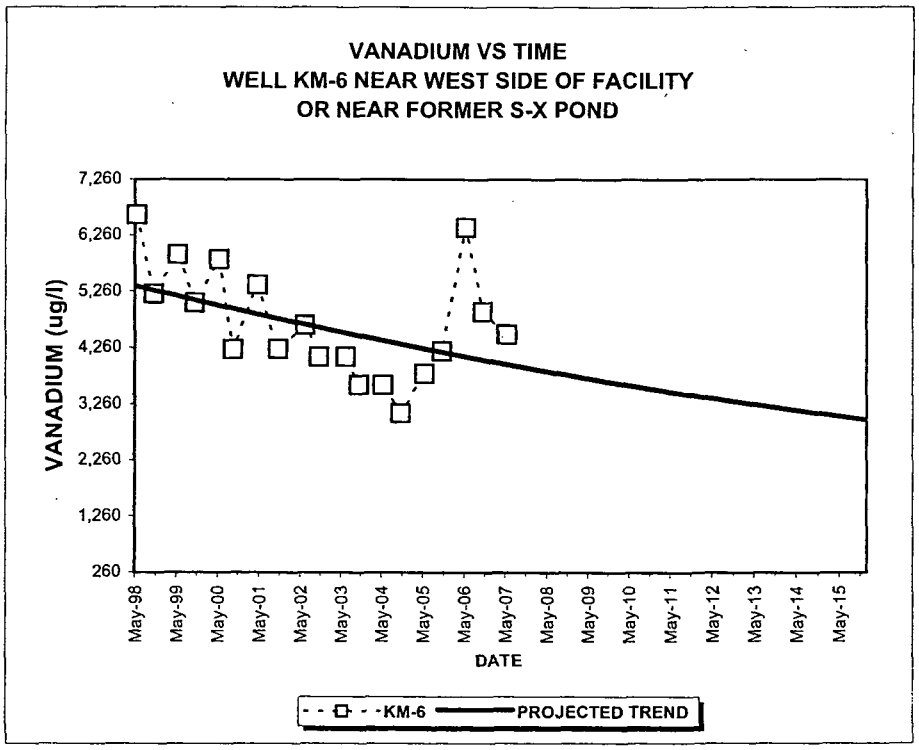




RBC FOR MOLYBDENUM IS 260 UG/L

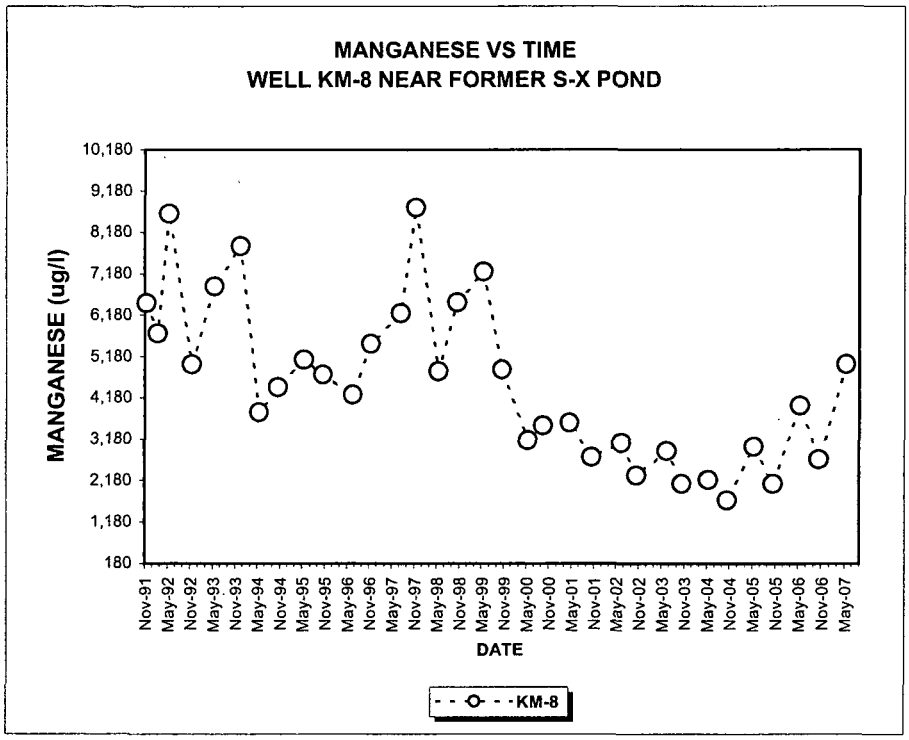
COC CONCENTRATIONS AND PROJECTED TRENDS VERSUS TIME

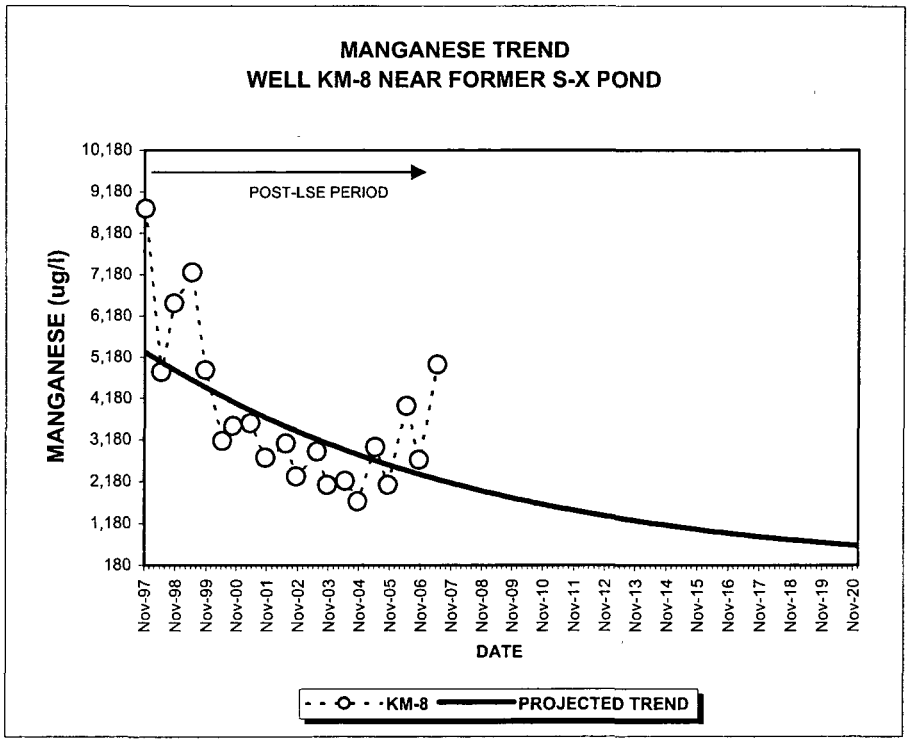




RBC FOR VANADIUM IS 260 UG/L

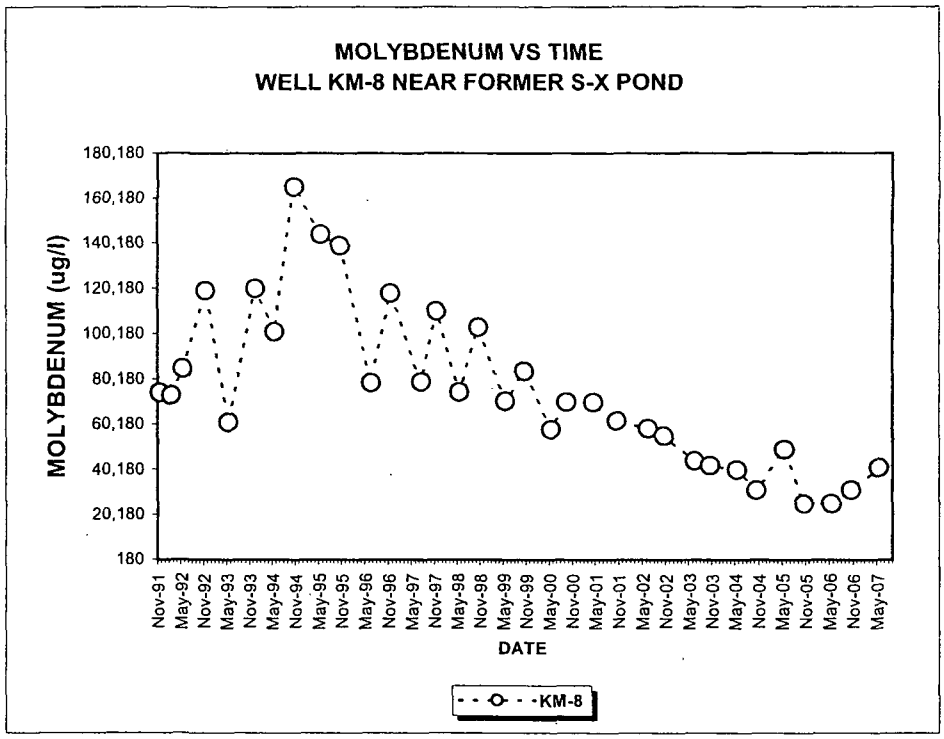
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

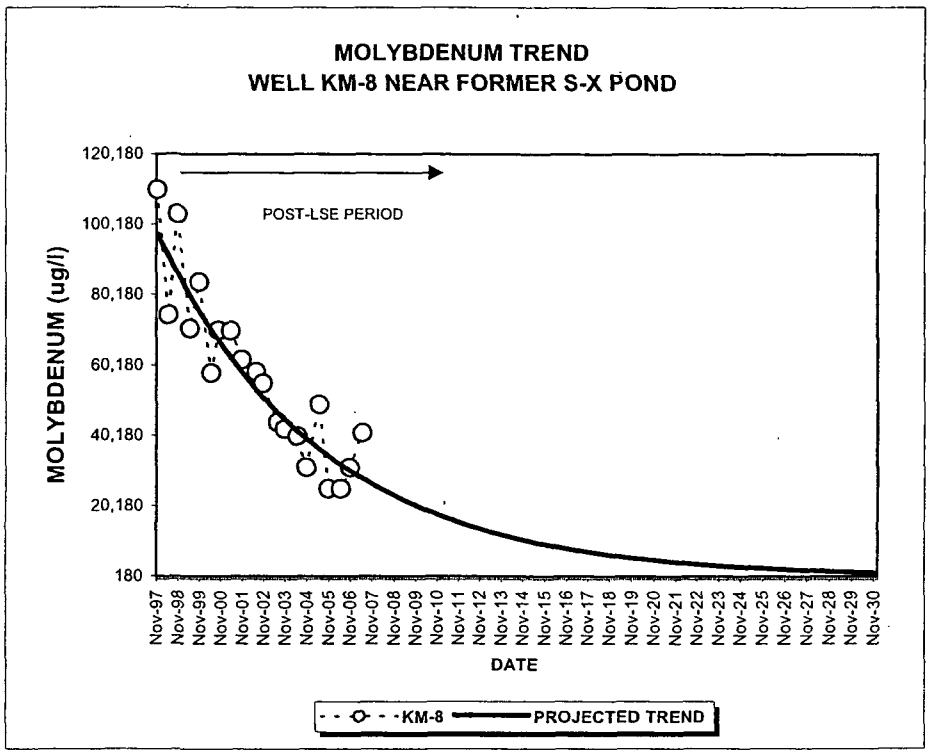




RBC FOR MANGANESE IS 180 UG/L
KM-8 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING LSE AND RECLAMATION

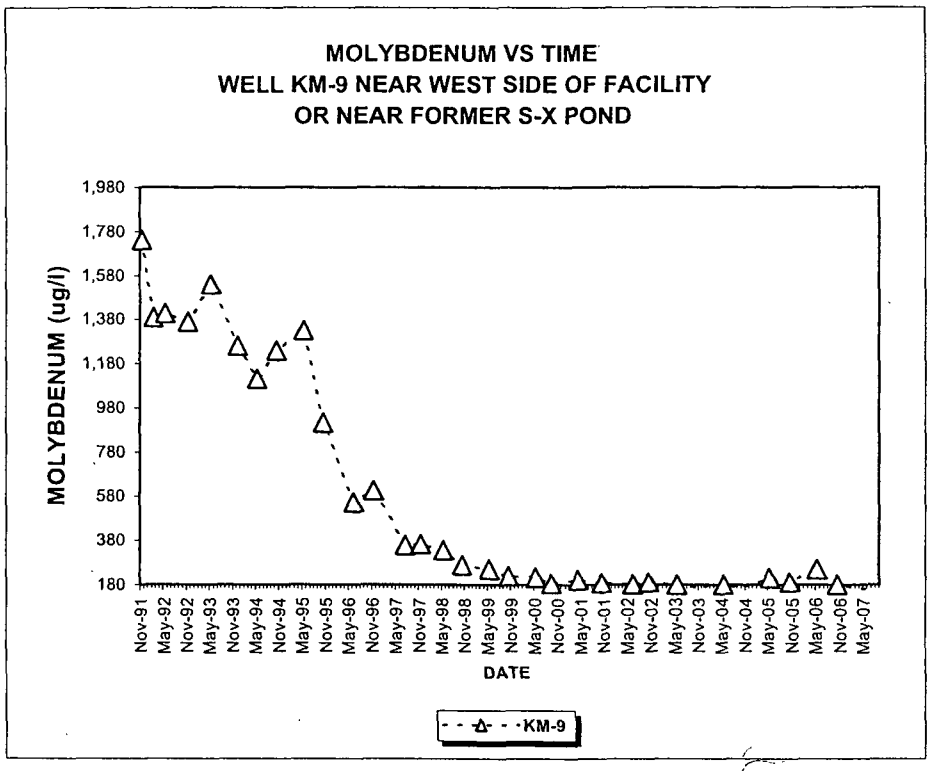
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

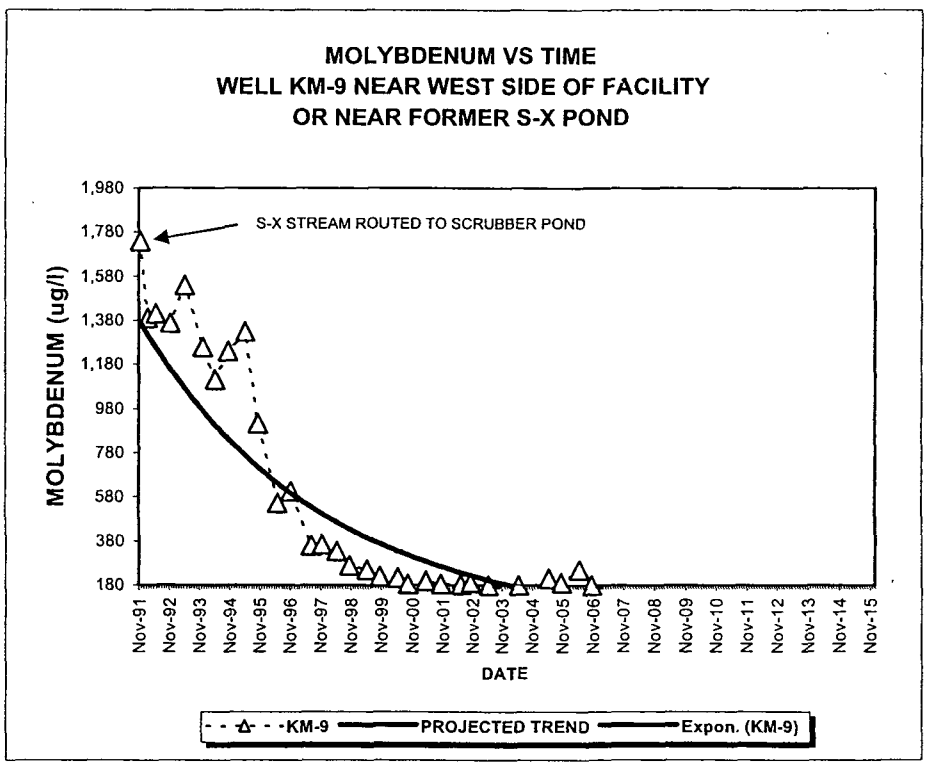




RBC FOR MOLYBDENUM IS 180 UG/L
KM-8 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING LSE AND RECLAMATION

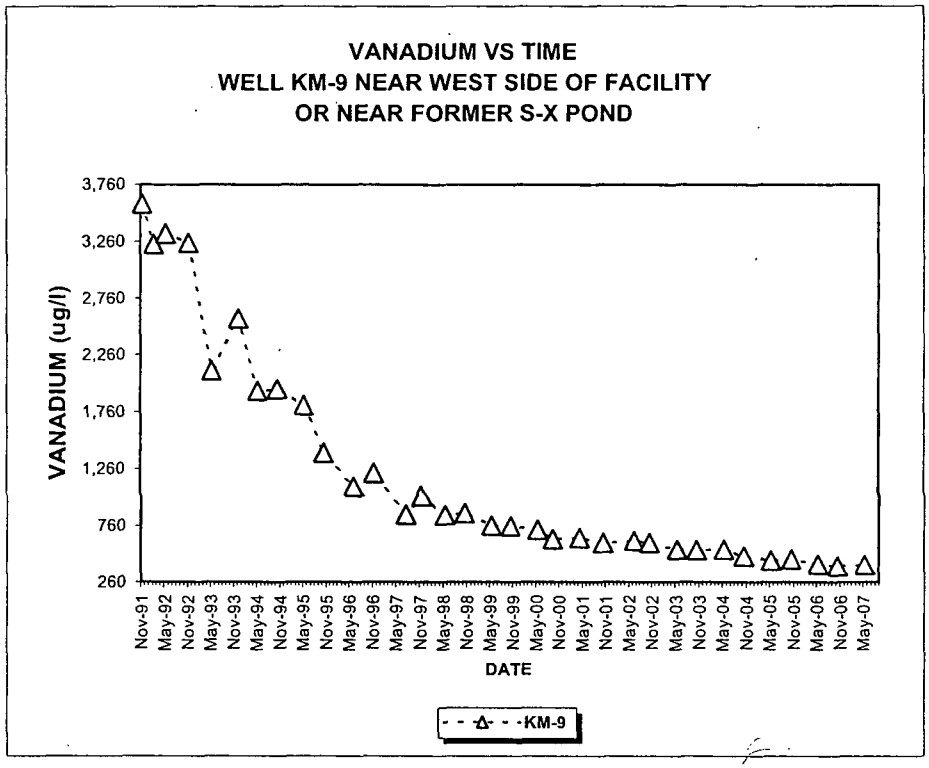
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

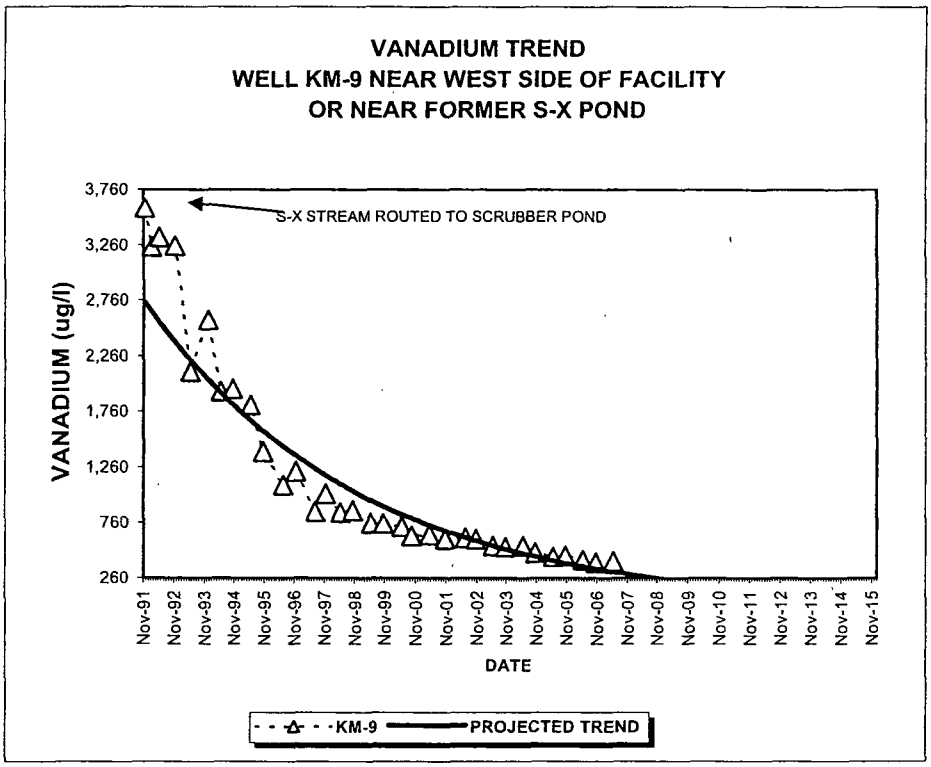




RBC FOR MOLYBDENUM IS 180 UG/L
KM-9 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING REROUTING OF S-X STREAM

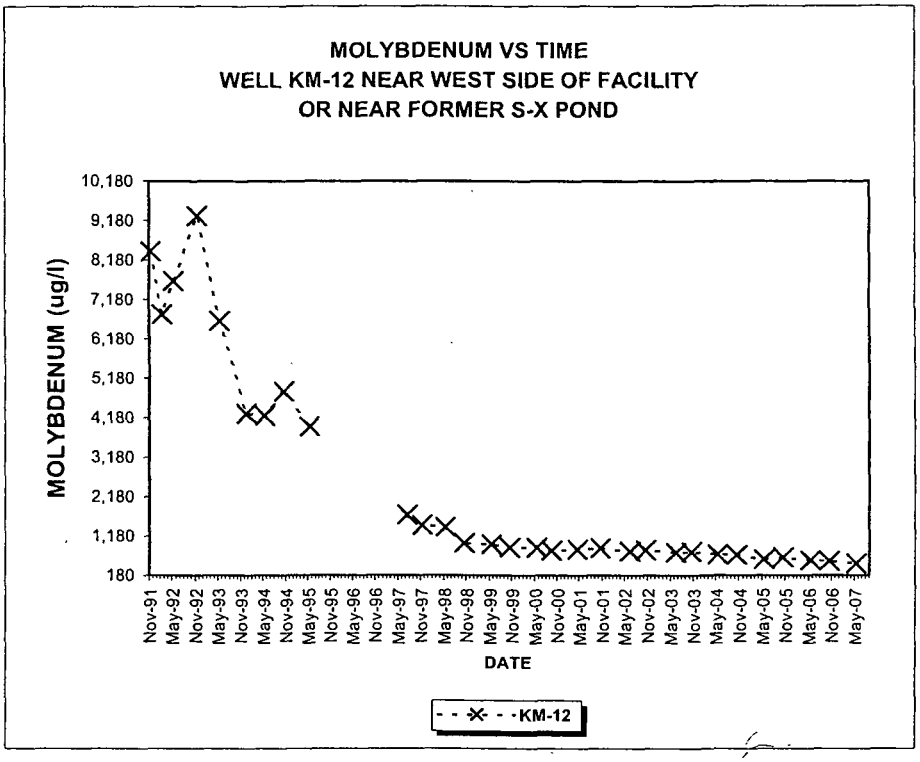
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

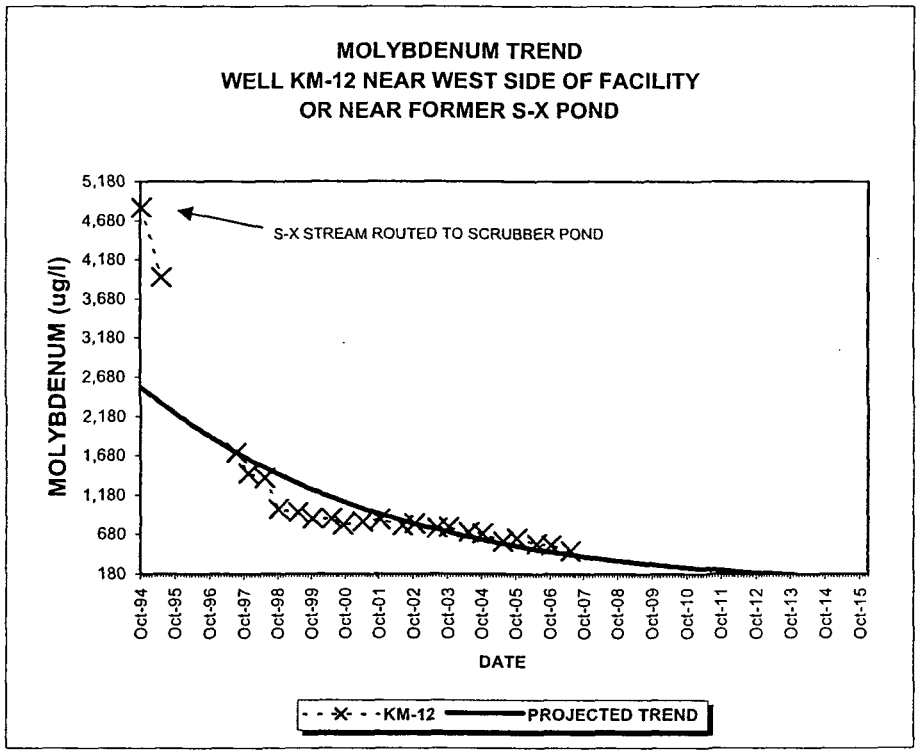




RBC FOR VANADIUM IS 260 UG/L
KM-9 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING REROUTING OF S-X STREAM

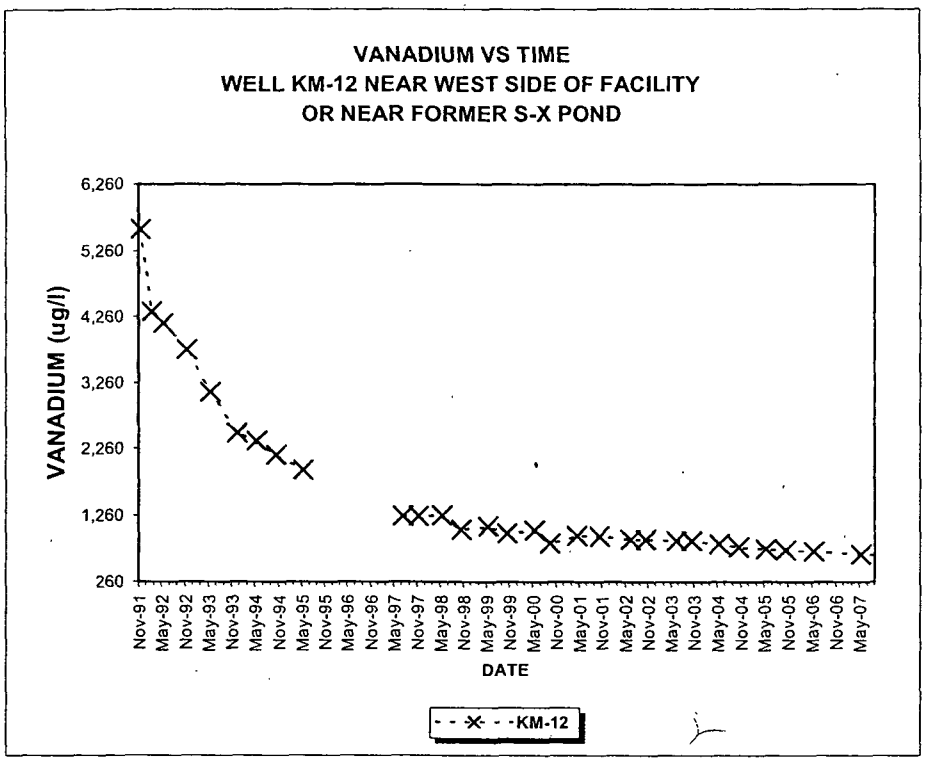
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

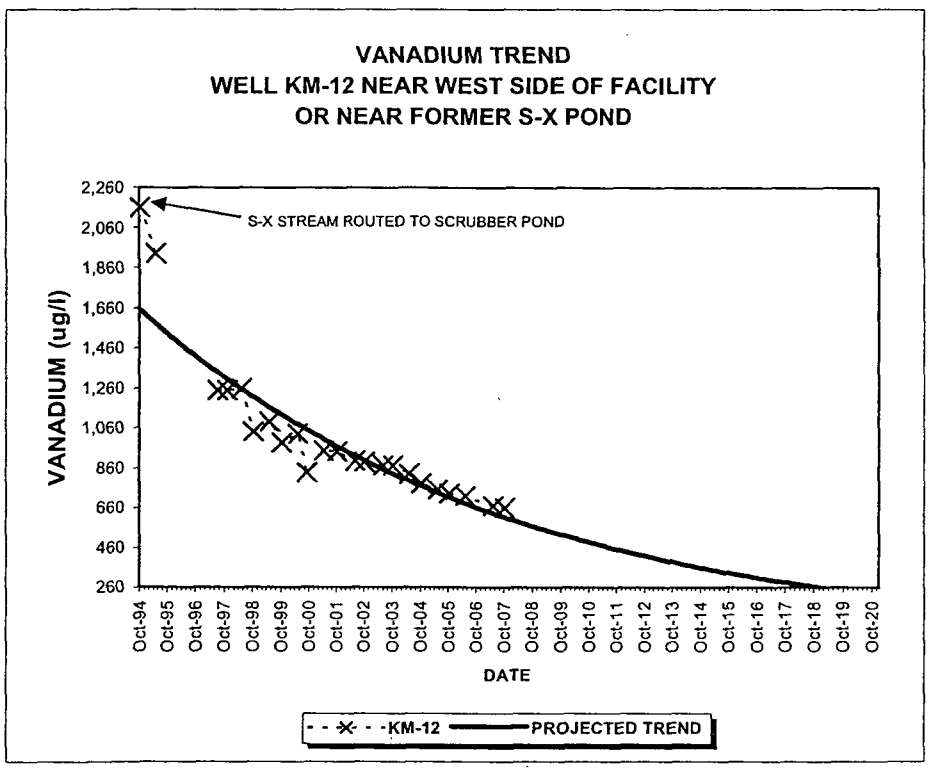




RBC FOR MOLYBDENUM IS 180 UG/L
KM-12 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING REROUTING OF THE S-X STREAM

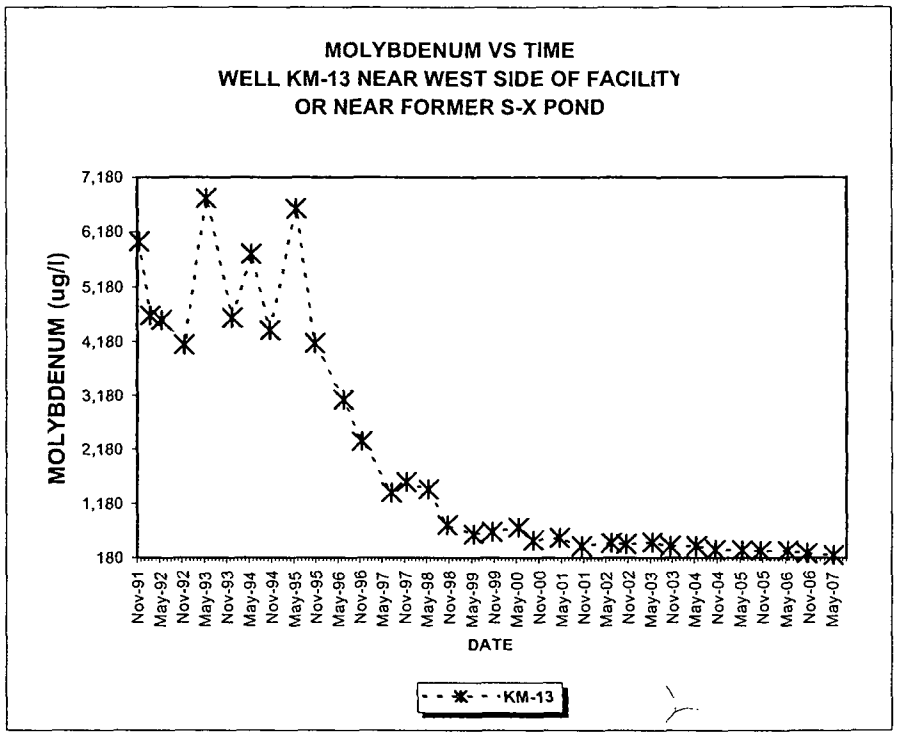
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

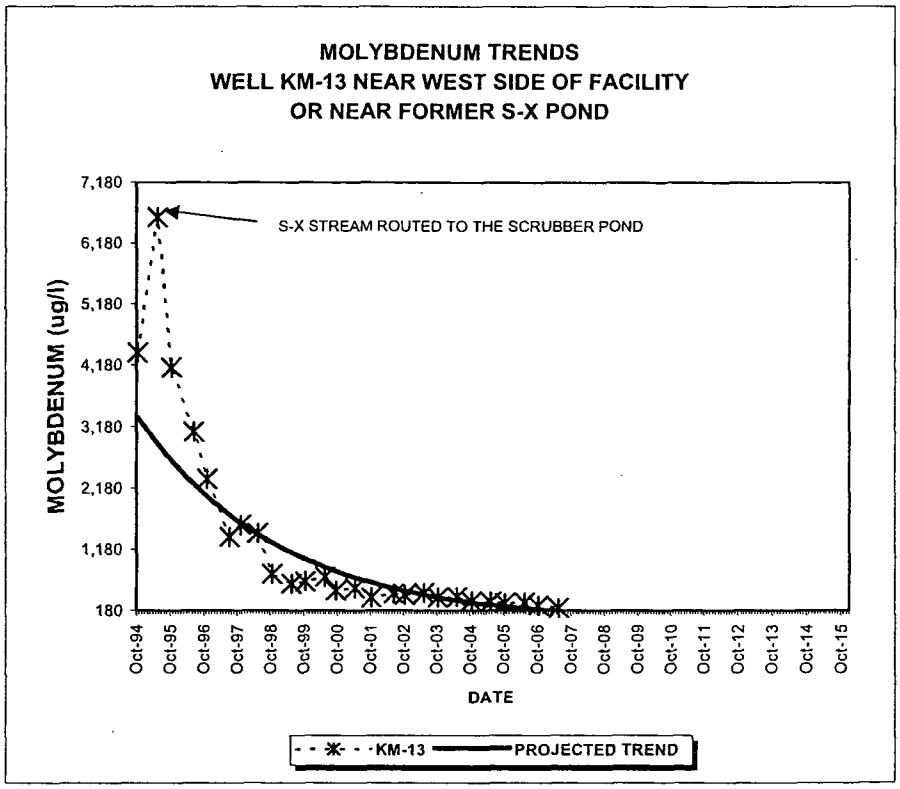




RBC FOR VANADIUM IS 260 UG/L
KM-12 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING REROUTING OF THE S-X STREAM

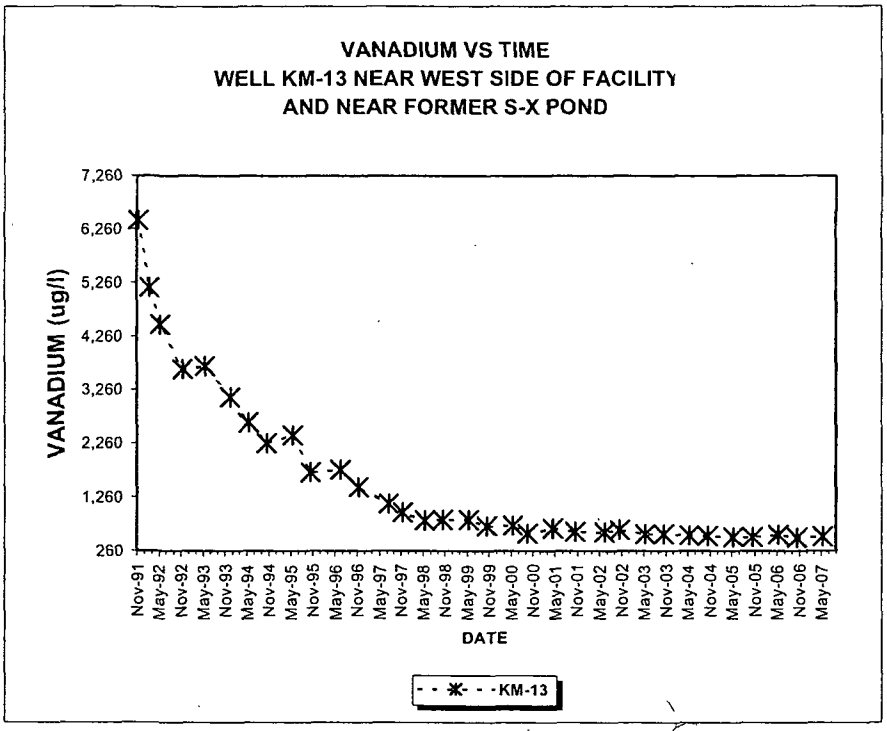
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

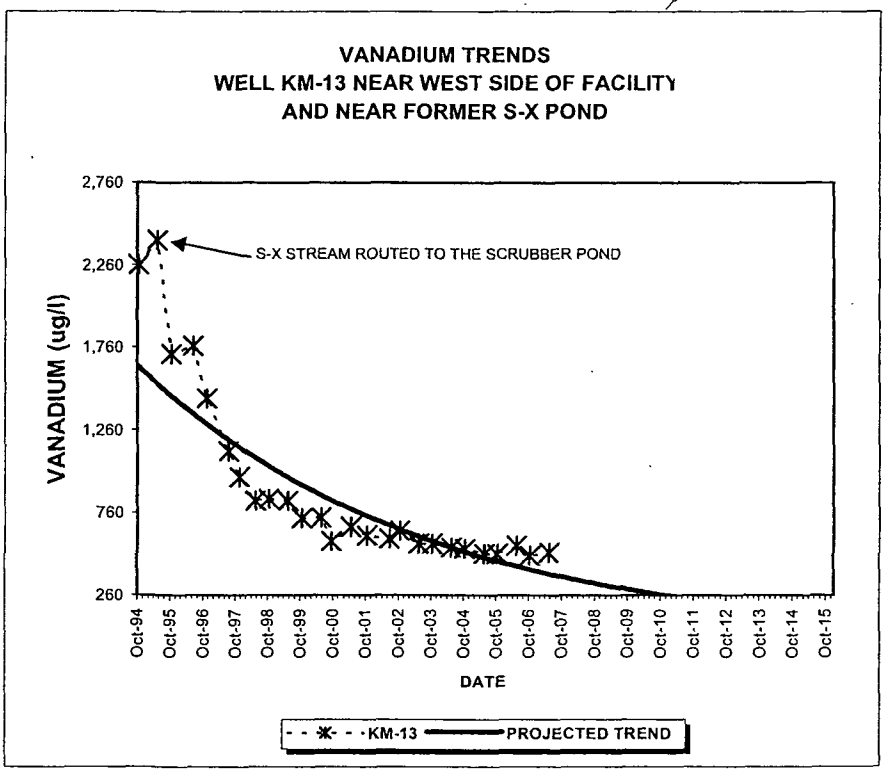




RBC FOR MOLYBDENUM IS 180 UG/L
KM-13 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING REROUTING OF THE S-X STREAM

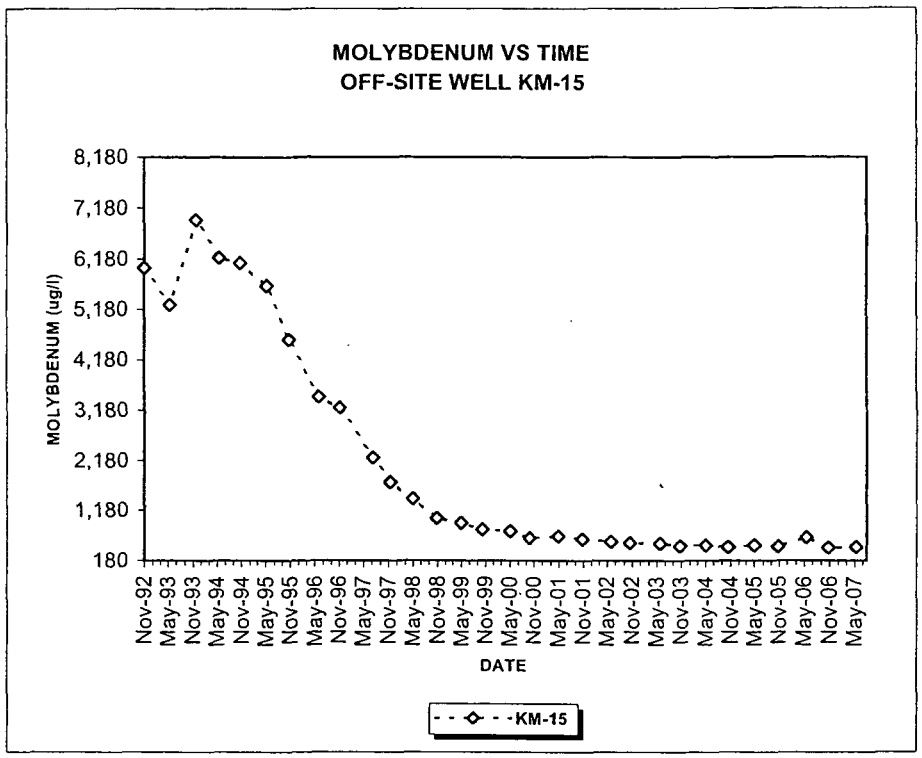
COC CONCENTRATION TRENDS WITH TIME AND PROJECTED TRENDS

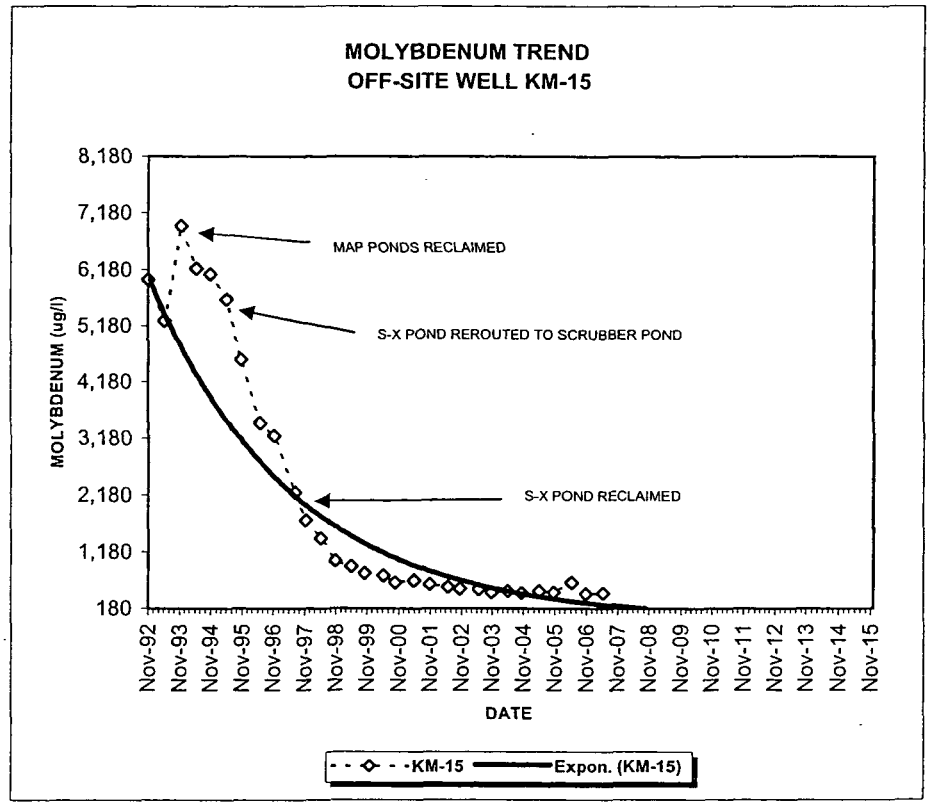




RBC FOR VANADIUM IS 260 UG/L
KM-13 IS A POC WELL
PROJECTED TRENDS BASED ON OBSERVATIONS FOLLOWING REROUTING OF THE S-X STREAM

COC CONCENTRATIONS WITH TIME AND PROJECTED TRENDS





RBC FOR MOLYBDENUM IS 180 UG/L

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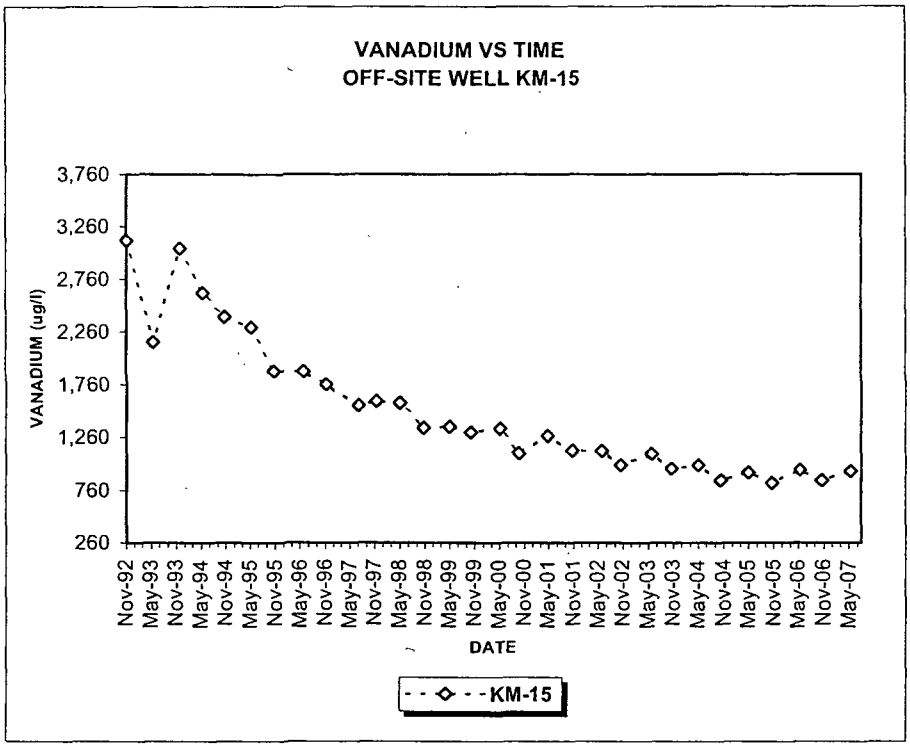

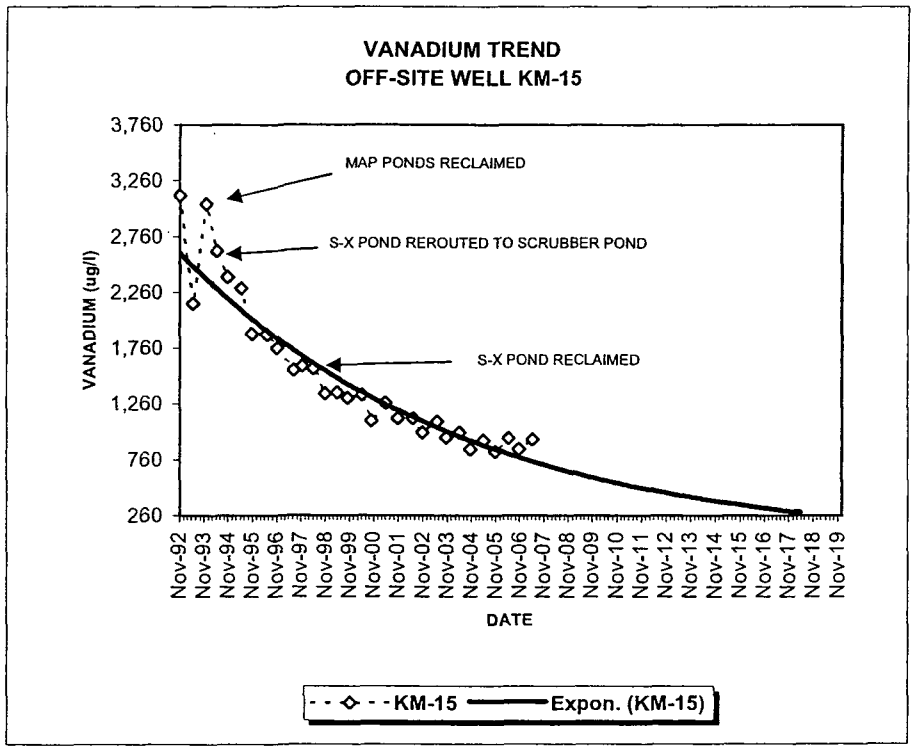

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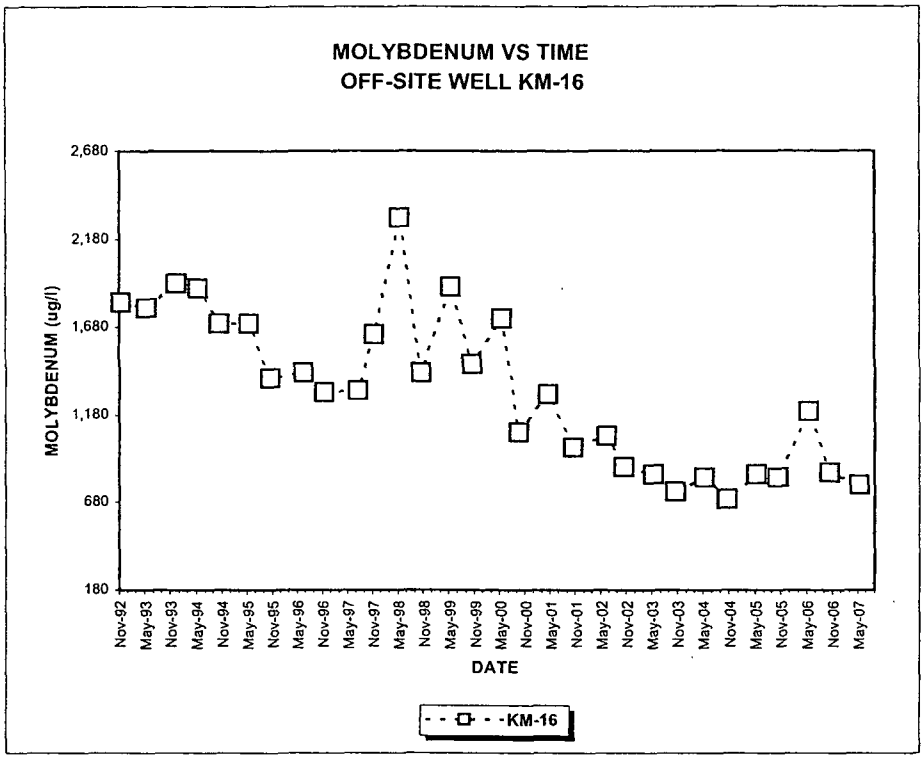

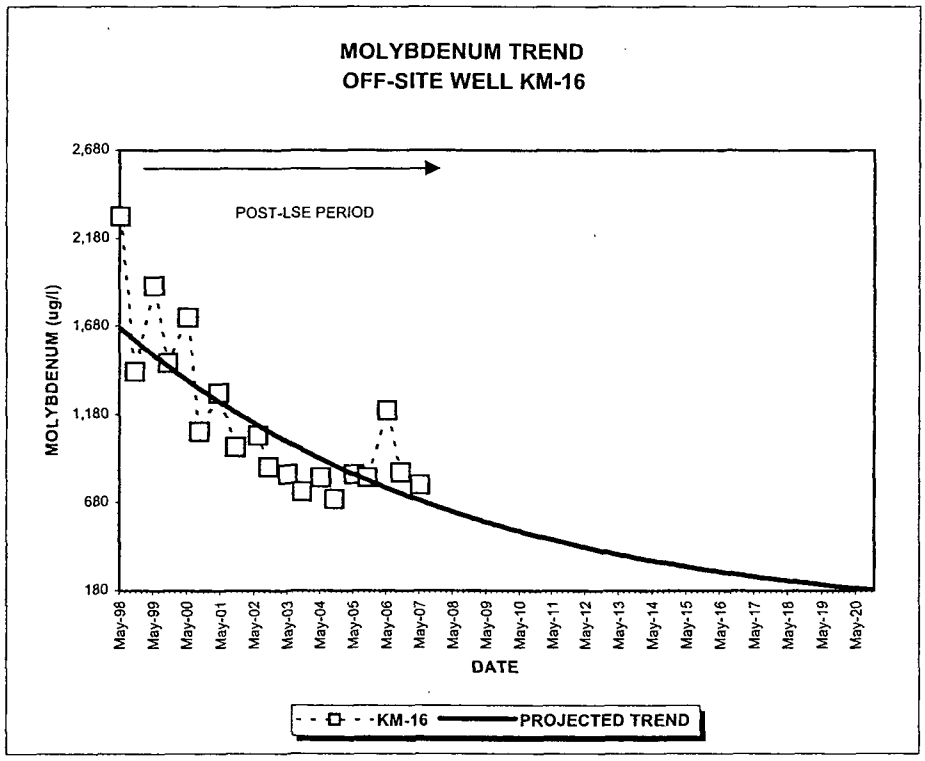

RBC FOR MOLYBDENUM IS 180 UG/L
PROJECTED TREND BASED ON OBSERVATIONS FOLLOWING
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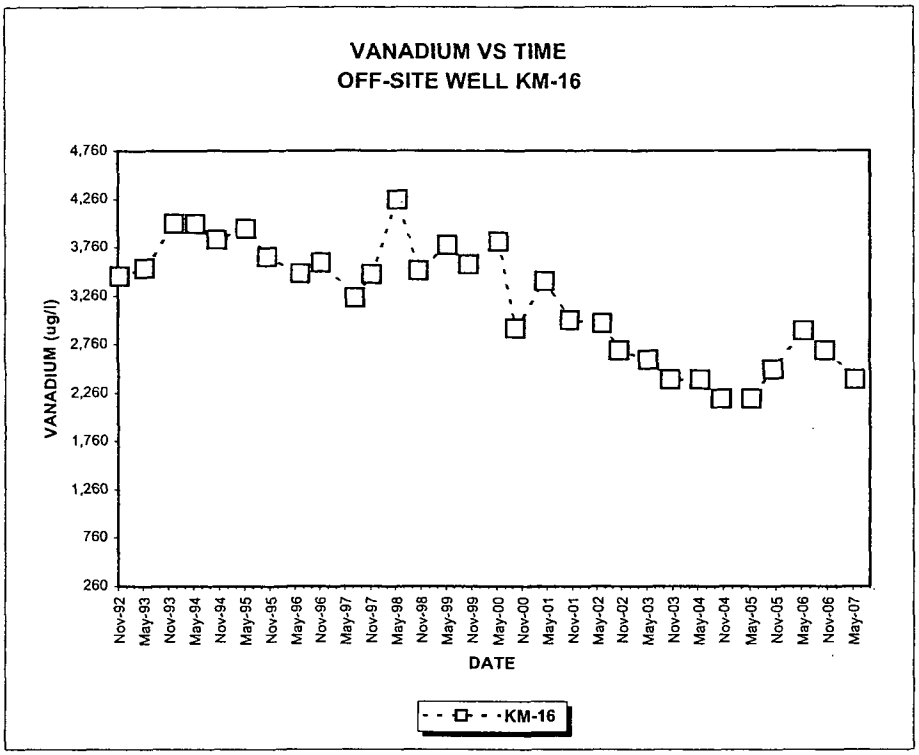
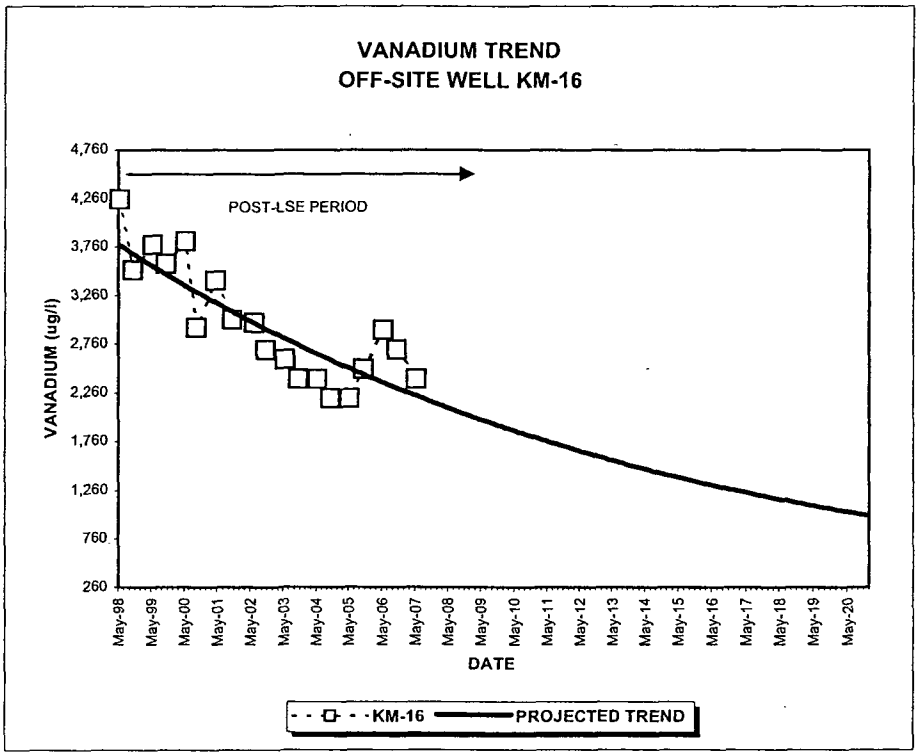
COC CONCENTRATIONS WITH TIME AND PROJECTED TRENDS





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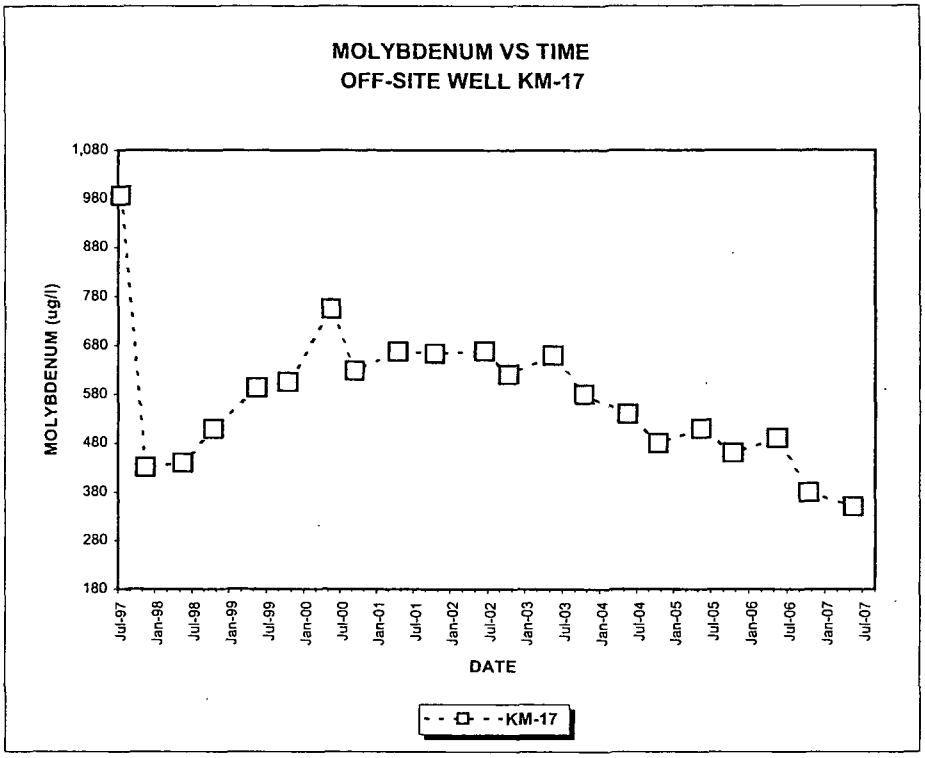

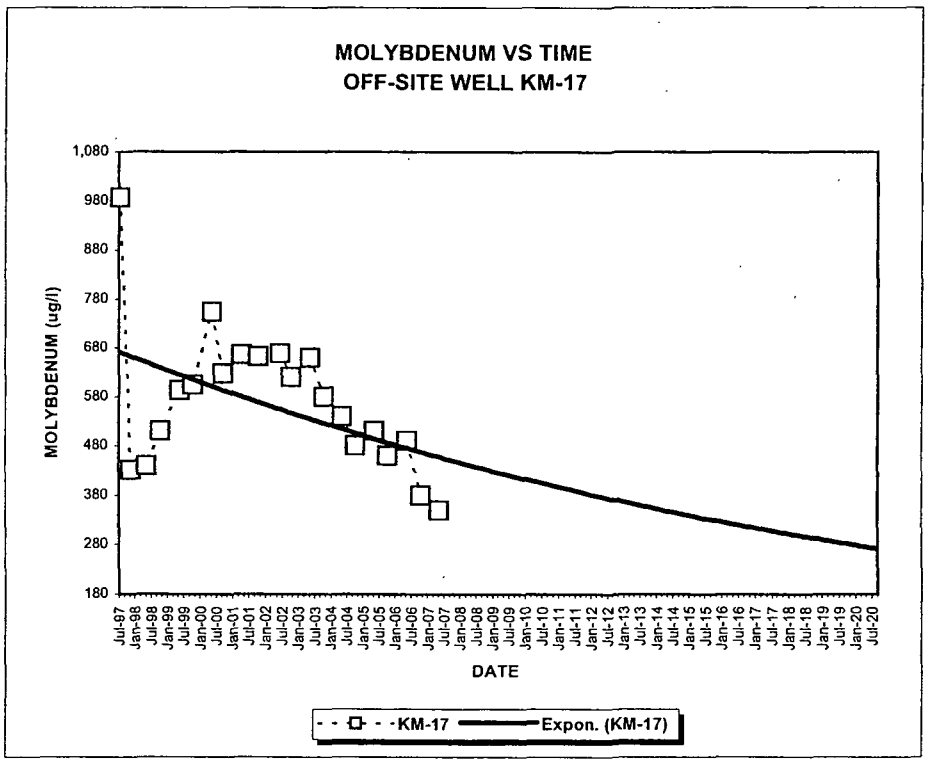

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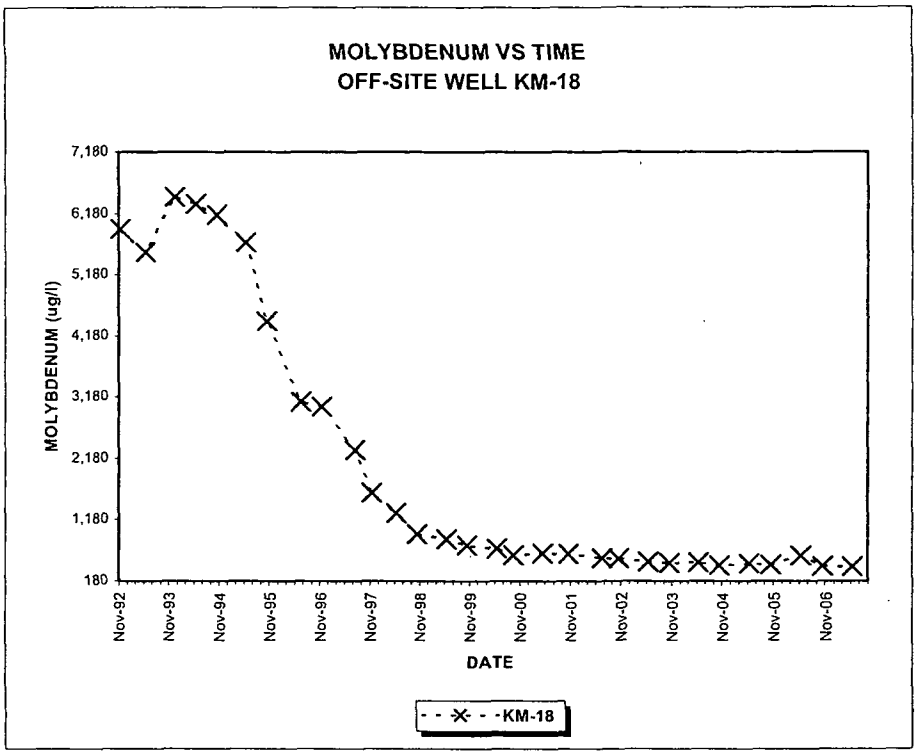

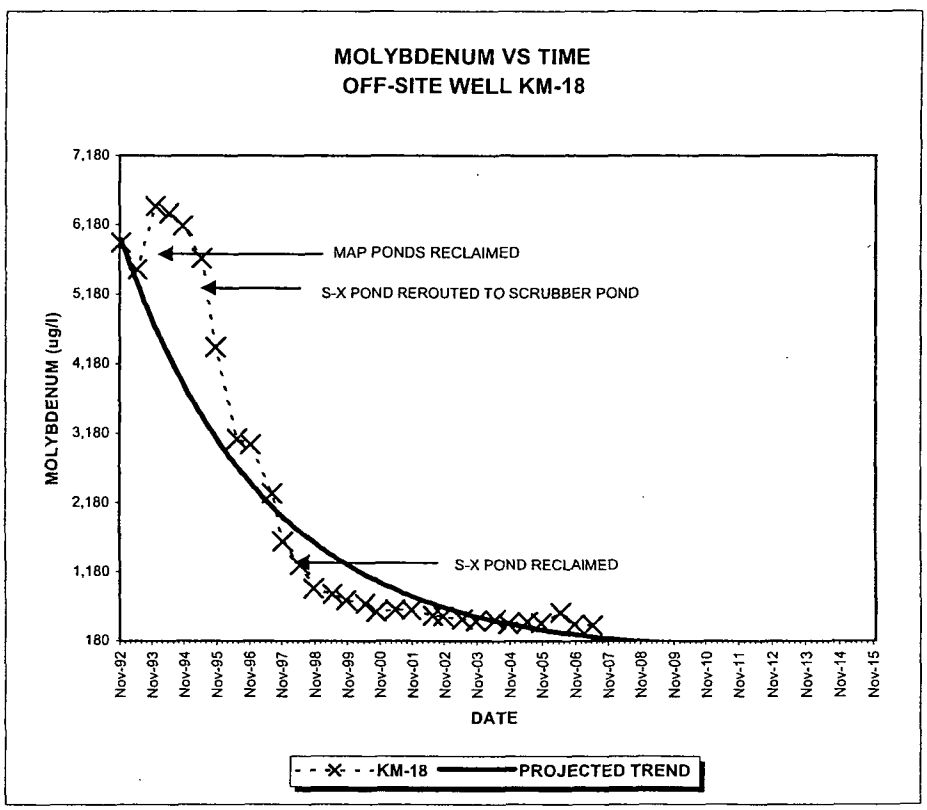

RBC FOR MOLYBDENUM IS 180 UG/L

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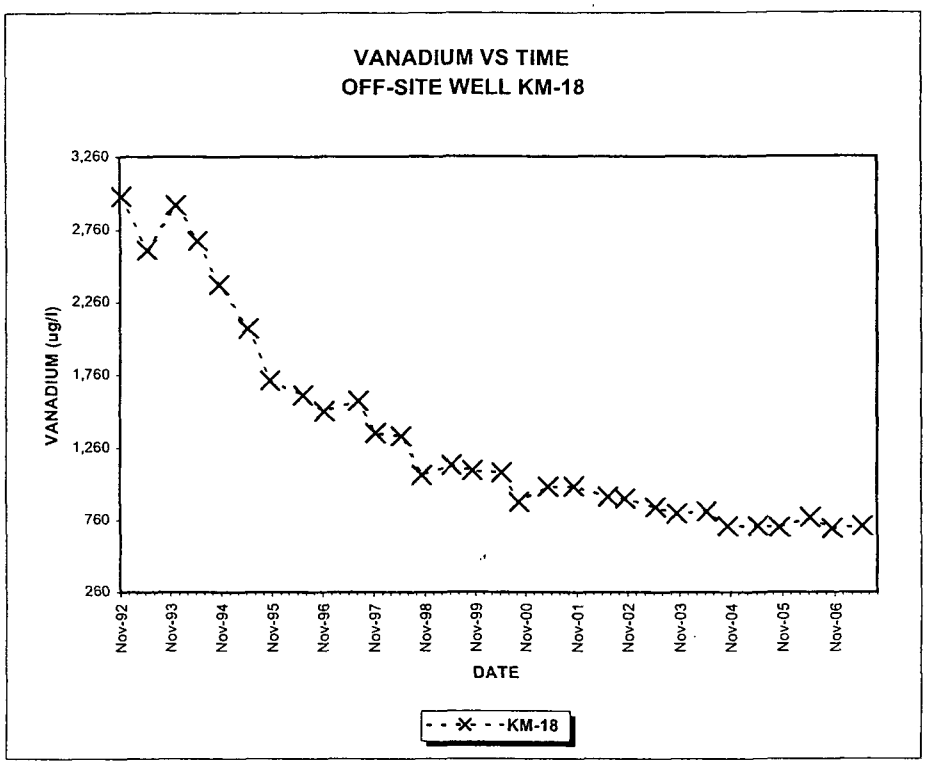

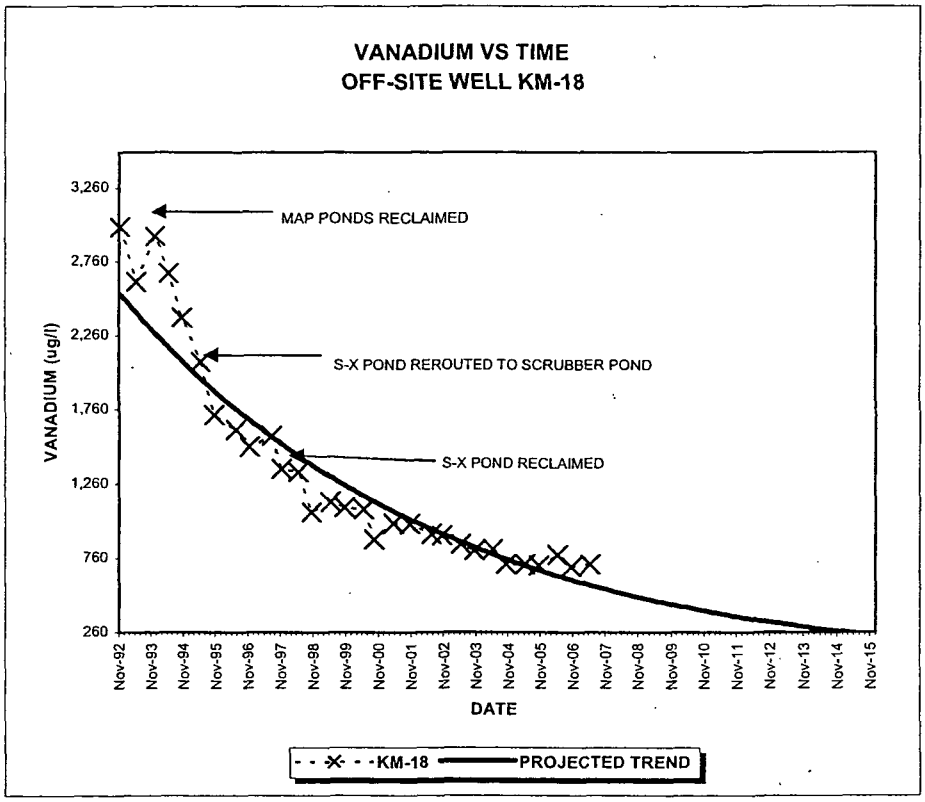

APPENDIX B

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Golder Associates

2007 SUMMARY REPORT

GROUNDWATER CONDITIONS AT THE MONSANTO SODA SPRINGS PLANT

SODA SPRINGS, IDAHO

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ENVIRONMENTAL QUALITY

Submitted to:

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Soda Springs, Idaho 83276

Submitted by:

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November 28, 2007

913-1101.605A

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1.0 INTRODUCTION

The Monsanto Soda Springs Plant is located approximately one mile north of the City of Soda Springs, Caribou County, Idaho (Figure 1). Monsanto conducted a Remedial Investigation / Feasibility Study (RI/FS) under an Administrative Order on Consent (AOC) with the U.S. Environmental Protection Agency (USEPA). The purpose of the RI/FS (which began in 1991) was to determine the nature and extent of constituents at and near the Plant. The investigation included evaluations of soil, sediments, air emissions, surface water and groundwater.

A Record of Decision (ROD) was agreed upon by Monsanto and USEPA (USEPA 1997) that prescribes selected remedies for the affected environmental media at the site. For groundwater, the selected remedy is monitored natural attenuation with institutional controls. This remedy was selected based on groundwater modeling results, as described in Section 1.1.2, that predict restoration of groundwater to concentrations below the remediation goals.

Annual groundwater and effluent discharge monitoring is conducted at and near the Plant in order to ensure that natural attenuation is proceeding per modeled predictions, and to monitor the attenuation process. This report summarizes the results of the 2007 annual groundwater monitoring at the Soda Springs Plant site. This summary is based on the groundwater quality data collected up to and including the 2007 sampling round, conducted from June, 19 through 25, 2007. Four new monitoring wells drilled south of the Plant were sampled on July 10, 2007.

1.1 Background

The Monsanto Soda Springs Plant is located one mile north of the City of Soda Springs, Caribou County, Idaho (Figure 1). The site covers an area of approximately 800 acres, with the plant accounting for 540 acres. Wells and springs at and in the vicinity of the Plant are shown on Figures 2 and 3 for the Upper Basalt Zone (UBZ) and Lower Basalt Zone (LBZ), respectively. Operational facilities are shown on Figure 4. Well completion information is summarized in Table 1 for monitoring and plant production wells at and in the vicinity of the Plant.

1.1.1 Hydrogeology

The hydrogeology at the Monsanto Plant is presented in detail in Golder 1995. The primary hydrostratigraphic zones underlying the Monsanto Plant include the Upper Basalt Zone (UBZ) and the Lower Basalt Zone (LBZ). The principal aquifer is the UBZ, which extends to a depth of 100 feet bgs below the plant. Depth to the water table ranges from 20 feet bgs in the northeast corner to 100 feet bgs in the center of the plant. Groundwater flow in the UBZ and LBZ is a function of faulting, regional hydrogeologic conditions, and pumping of the plant production wells. The UBZ and LBZ are broken into smaller regions (UBZ-1 through UBZ-4 and LBZ-1 through LBZ-4), based on hydrogeological controls and groundwater quality (Figures 2 and 3). Details pertaining to the breakdown of UBZ and LBZ regions are provided in Golder 1995.

1.1.2 History of Groundwater Effects

Table 2 presents a history of groundwater investigations at the Monsanto site. Golder was initially employed to assess the impact of operations on groundwater and surface water quality at the Monsanto Plant in 1984. The 1984 study found elevated concentrations of cadmium, selenium, fluoride and sulfate in groundwater beneath the plant.

In 1992, a RI/FS was conducted by Golder and submitted to EPA. A Phase II RI/FS was conducted and submitted to EPA in 1995. Bi-annual groundwater monitoring occurred from 1991 to 1998, and annual groundwater monitoring has occurred since 1998.

Groundwater affected by Monsanto activities is mainly confined to the UBZ within the plant, with groundwater flow toward the south plant fenceline. The migration of plumes originating within plant boundaries is monitored by wells located at the source areas, the south fenceline, and at the southern boundary of the site.

There are two constituent plumes on the site originating from Monsanto operations. Affected groundwater originates from three principal source areas within the Monsanto Plant (Figure 4):

- Old UFS ponds (UBZ-2);
- Northwest pond (UBZ-4); and
- Old hydroclarifier (UBZ-4).

The plume from the old UFS ponds occurs in the UBZ-2 groundwater zone and flows within the groundwater system toward the south. The plumes from the northwest pond and the old hydroclarifier occur in the UBZ-4 zone and flow southward toward the plant production wells used for non-contact cooling water supply. Pumping from the production wells PW-01, PW-02, and PW-03 from UBZ-4 contains the plumes originating from the northwest pond and the old hydroclarifier areas to prevent offsite migration. There are other minor source areas on the site such as the former sewage lagoon, the unlined non-contact cooling water ponds, and the old coke and quartz ponds that are part of the UBZ-2 or UBZ-1 zones. The plume within the UBZ-2 zone is not controlled by pumping.

A fourth plume originates on Kerr McGee's plant site, and has spread onto the southeastern portion of the Monsanto Plant site in the UBZ-3 area. Groundwater under the southeastern portion of the plant had elevated concentrations of vanadium, chloride, molybdenum, ammonium, and sulfate attributed to the Kerr-McGee Chemical Corporation (Figure 1).

A groundwater solute transport model was developed as part of the Phase II RI for the Monsanto plant to predict the fate and transport of constituents in groundwater in the vicinity of the plant (Golder, 1995). The solute transport model was developed for the portion of the plant where there is potential for off-site transport of constituents in groundwater (the UBZ-2 zone). The model predicted concentrations to three endpoints south of the plant (the southern plant boundary, the estimated discharge point of the plume into Soda Creek, and the estimated discharge point of the plume into Bear River), as shown in Figure 2. Projections were calculated for constituent transport for a period of over 100 years.

In 2003, Golder conducted a Five-Year Review of the groundwater remedy employed at the Plant (Golder 2003a), per conditions set in the Record of Decision (ROD). The Five-Year Review is the first of a series of reviews required to determine whether the remedy remains protective, to confirm that constituent concentration trends in groundwater are declining as predicted, and, eventually, confirm the achievement of Maximum Contaminant Levels (MCLs). A second Five-Year Review will be submitted in early 2008, covering the period from 2003 to 2007, inclusive.

The 2003 Five-Year Review report included statistical trend analyses and comparisons of groundwater and outfall quality to regulatory levels, remediation goals, and groundwater modeling

projections to determine if/when remediation goals have been achieved, and if not, that institutional controls are still in place and effectively preventing human exposure.

As part of the 2003 Five-Year Review, a revised groundwater model was developed to provide a more accurate projection of constituent concentrations in the UBZ-2 zone south of the Monsanto plant. The model was revised to account for observed changes in groundwater quality since the contaminant transport model was developed in 1993, and re-interpretation of the source area history and groundwater quality data from monitoring wells. The revised model used Goldsim (2002), a graphical, probabilistic modeling tool.

Four new monitoring wells (2007 Monitoring Wells; TW-59, TW-60, TW-61, and TW-62) were installed south of the Southern Boundary wells in June and July 2007 to help delineate the southern extent of the groundwater plume in UBZ-1 and UBZ-2 (Golder 2007). The well locations are shown on Figure 2. The new wells were sampled in July 2007 and the results of the groundwater sampling are included in this report.

1.2 Record of Decision

The United States Environmental Protection Agency (USEPA) submitted a ROD in 1997 for the Monsanto site that presented the selected remedy for environmental media affected by plant operations (EPA 1997). The selected remedy for groundwater is monitored natural attenuation with institutional controls to prevent human exposure to groundwater until groundwater quality improves to concentrations less than the remedial goals.

The ROD established groundwater remediation goals for the constituents of concern: cadmium, fluoride, nitrate, selenium, and manganese. The remediation goals are the MCLs under the Safe Drinking Water Act for cadmium, fluoride, nitrate, and selenium, and a risk-based concentration for manganese, as shown in Table 3.

TABLE 3

Groundwater Remediation Goals for the Monsanto Plant

Parameter	Remediation Goal (mg/L)	Regulatory Source
Cadmium	0.005	Maximum Contaminant Level
Fluoride	4	Maximum Contaminant Level
Nitrate as NO_3/ Nitrate as N	44 /10	Maximum Contaminant Level
Selenium	0.05	Maximum Contaminant Level
Manganese	0.18	Risk-Based Concentration

The remediation goal for nitrate (44 mg/L) is the MCL for nitrate expressed as NO_3. However, the analytical data presented in this report are in the form of nitrate as expressed N. The remediation goal for nitrate as N is 10 mg/L.

The ROD established the points of compliance for remediation goal monitoring. Several modifications were made to the list of point of compliance wells, as described in Golder 1998, based on availability and accessibility of some wells. Based on the ROD and modifications to the ROD, the point of compliance wells are listed below:

- Production Wells - Wells PW-01, PW-02, and PW-03;
- Plant Fence Line - Wells TW-20, TW-34, TW-35, and TW-39;
- Southern Boundary - Wells TW-53, TW-54, TW-55, and Harris well; and,
- Soda Creek (surface water).

The Plant Fence Line wells are located inside the southern Plant fence line near Hooper Springs Road. The Southern Boundary wells are located within the Monsanto property boundary near its southern margin (about 1,200 ft south of the fence line).

Several sample locations have been established to monitor and evaluate discharges to surface water, and effects of discharges on surface water quality. These sample locations are not point of compliance locations, but are used to evaluate water quality in Soda Creek. The sample locations for surface water quality are listed below:

- Mormon Creek – Mormon Creek at its confluence with Soda Creek (sampled since 2002);
- Pond Inlet – Effluent inlet to the non-contact cooling water pond upgradient of the effluent discharge into Soda Creek (sampling initiated in 2004);
- Soda Upstream – Soda Creek upstream of the effluent discharge pipe (sampled since 2001);
- Soda Downstream – Soda Creek downstream of the effluent discharge pipe (sampled since 2001);
- Effluent Discharge – Effluent released into Soda Creek at the effluent discharge pipe (sampled in triplicate since 2000); and
- Soda Creek downstream of the effluent discharge, immediately upstream of the weir diverting flow to the irrigation canal (sampling initiated in 2005).

The data from the surface water stations will be compared to effluent discharged into Soda Creek to evaluate the effects of effluent discharge on surface water.

1.3 Report Organization

Sample collection activities carried out in June and July 2007 are summarized in Section 2. Groundwater flow directions are evaluated in Section 3 using depth to water measurements collected during the June 2007 sampling round.

Section 4 contains a discussion of analytical results. Constituent concentration trends are evaluated for the point of compliance wells and Soda Creek in Section 4.1. In addition, Section 4.2 includes evaluations of constituent concentration trends at several different areas around the plant and south of the plant. These areas include:

- Northwest Pond Area – Wells TW-28, TW-16, TW-17, and TW-18.
- Old UFS Ponds Area – Wells TW-22, TW-24, TW-37, and TW-45.
- UFS Piles Area – Wells TW-48, TW-49, and TW-50.
- Hydroclarifier Area – Wells TW-40, TW-43, and TW-44.
- South of the Plant Springs – Homestead and Mormon Springs, and Mormon Creek.
- 2007 Monitoring Wells - Wells TW-59, TW-60, TW-61, and TW-62.

Monsanto installed two new monitoring wells in July 2005 at the landfill located north of the plant. The two new wells were sampled for the first time in 2005, and have been added to the list of wells included in the annual groundwater sampling.

The constituents evaluated in Section 4 include the constituents of concern as well as several other indicator constituents. The indicator constituents are included to evaluate the changes in groundwater quality in response to Monsanto's remedial actions.

Section 5 provides a summary of the findings of these evaluations.

Appendices A through I present time-history graphs for selected constituents and groundwater elevation hydrographs. Appendix J presents the data validation report for the analytical data from the 2007 sampling round.

2.0 SAMPLE COLLECTION AND ANALYTICAL ACTIVITIES

In June and July 2007, Golder collected groundwater measurements and samples per the annual sample collection requirements of the ROD. Sample collection occurred from June 19 to 25, 2007. Additional samples from four new wells (2007 monitoring wells) completed south of the Southern Boundary Wells were collected on July 10, 2007. Groundwater samples were collected from 45 wells and 12 surface water locations during this period, as listed in Table 4. The twelve surface water locations include springs to the south of the Plant; the mouth of Mormon Creek; the effluent discharge pipe at Soda Creek (Effluent 1 through 3); the inlet to the effluent discharge pond (Pond Inlet); and Soda Creek upstream and downstream of the effluent discharge pipe as well as above the downstream weir. Groundwater elevations were measured at all accessible monitoring wells during this period, as described in Section 3.

Quality control samples were collected throughout the sampling event, and include the following:

- Duplicate Samples – Field duplicate samples were collected at five locations, representing at least 5% of all monitoring samples collected;
- Equipment Blank Samples – Equipment blank samples were collected from distilled water poured over decontaminated non-dedicated sampling equipment. An equipment blank sample was collected from the Grundfos pump; and
- Split Samples – Split samples were collected at five monitoring well locations, representing at least 5% of all monitoring samples collected. These samples were shipped to an alternate laboratory for the same analyses as the other samples.

Groundwater samples were collected using the general procedures described in Section 2.1. All springs were collected as grab samples, as described in Section 2.2. All water samples were analyzed for constituents listed in Table 5, per the requirements of the Quality Assurance Plan for the project.

2.1 General Procedures for Well Sampling

At each well, the groundwater elevation was measured and the well volume calculated using the well completion information (Table 1). All equipment used in the course of sample collection (i.e., water level tape, water quality meter probes, and non-dedicated down-hole pumps) was decontaminated prior to use at each well with distilled water at a minimum, and Alconox detergent, if necessary.

2.1.1 Well Purging

To ensure sampling of fresh groundwater rather than stagnant water in the well, groundwater was pumped at each sampled well until at least three well volumes were purged. Groundwater was purged either onto the ground or into a tank (to be disposed into the seal water pond), as designated in Table 4. The purge water was monitored for dissolved oxygen, pH, conductivity, temperature, and turbidity until these parameters stabilized. Samples were collected once three well volumes were purged, the water quality parameters had stabilized, and the turbidity of the groundwater was less than five NTU. Filtering of samples was necessary at TW-40 and TW-43 collected using a bailer because the turbidity remained above the 5 NTU threshold.

2.1.2 Sample Collection

Samples were collected as grab samples using the appropriate sample containers. Some sample containers contained preservative, as appropriate for the intended analyses. Once the samples were

collected, they were labeled and stored in a cooler at 4 degrees C. Samples were shipped daily via overnight delivery to the laboratory for the analyses listed in Table 5. All samples were kept under chain of custody through shipment to the laboratory.

There are four methods used to collect groundwater samples from wells, as shown in Table 4. The well sample collection methods are dedicated pump, Grundfos (non-dedicated) pump, hand-bailed, and operating well, as described below.

1. Dedicated Pumps

Monsanto keeps a dedicated well riser for each monitoring well containing a dedicated pump. For sample collection, the corresponding well riser was attached to the well top, and the pump's electrical connection was attached to a generator with the appropriate plug and starter box. Groundwater purging and sample collection proceeded as described in the general procedures.

2. Non-Dedicated Pumps

A non-dedicated Grundfos pump was used in wells that do not contain dedicated pumps (Harris well, TW-08, TW-24, and TW-38). The Grundfos pump was decontaminated inside and out prior to use at each well, and was lowered to a few feet below the water table. Groundwater purging and sample collection proceeded as described in the general procedures.

3. Hand-Bailed Wells

In the event that there is insufficient water in a well to pump three well volumes, dedicated Teflon hand-bailers were used to purge groundwater. During the 2007 sampling round, wells TW-40 and TW-43 were hand bailed.

4. Operating Wells

Five wells that are regularly operated are also sampled. These wells include four Monsanto plant production wells and one residential well.

Plant production wells are plumbed directly into the plant water supply and are operated by automatic switches. The well casings for the production wells are inaccessible for groundwater level measurement and direct purging as in the other monitoring wells. Groundwater was collected as grab samples from the ports within the well houses for each production well. If a production well was not in operation at the time of sample collection, then a manual override of the automatic switch was used to start the well. In the case of manual operation, the production well was run for at least five minutes prior to sample collection in order to purge the plumbing lines of stagnant water.

The Lewis well is a private residential well located to the southeast of the Plant that is used for irrigation. The well casing for the Lewis well is inaccessible for groundwater level measurement and direct purging as in the monitoring wells. Groundwater was collected as a grab sample from an outside hydrant. The pump was turned on and ran for at least five minutes prior to sample collection in order to purge the plumbing lines of stagnant water.

2.2 General Procedures for Spring and Surface Water Sampling

The springs, surface water, pond inlet, and effluent discharge samples were collected as grab samples at all listed locations using the same general procedures as for wells. Water quality parameters were

collected at each of these locations, but were not required to stabilize prior to sample collection. Spring, surface water, pond inlet, and effluent samples were not filtered regardless of turbidity.

2.3 Sample Analyses

The samples collected in June and July 2007 were shipped to a primary laboratory (SVL Analytical in Kellogg, Idaho) for the analyses listed in Table 5. In addition, samples from wells TW-12, TW-33, TW-35, TW-55, and TW-61 were shipped to a split laboratory (ARI in Seattle, Washington) for the same analyses. Data validation was conducted on the data received from the laboratories to review and evaluate the procedures and methods used by the laboratories. Data validation evaluates the quality and quantity of the data received from the laboratories, and provides qualification of data that are outside of prescribed limitations. The data validation report for the June and July 2007 sampling round is presented in Appendix J.

3.0 GROUNDWATER ELEVATIONS

The depth-to-groundwater measurements collected during the June and July 2007 sampling round were converted to groundwater elevations based on surveyed measurement point information. The groundwater elevations are presented in Table 6. Figures 5 and 6 provide groundwater contour maps showing the interpreted directions of groundwater flow underlying the plant for the UBZ and the LBZ, respectively.

In the UBZ, groundwater flow is predominantly from north to south. In the northeast corner of the plant, groundwater also flows into the plant area from the northeast. The four production wells (PW-01, PW-02, PW-03, and PW-04) create two areas of depressed groundwater levels. One area of depressed water levels occurs surrounding PW-04 at the north end of the plant, and a second area occurs surrounding PW-01, PW-02, and PW-03 located in the center of the plant. Groundwater flow at the southern boundary is in a southerly direction. Groundwater eventually begins to flow southwest toward Mormon Creek and Soda Creek.

In the LBZ, groundwater flow follows a pattern similar to that observed in the UBZ. The groundwater flow pattern observed for June and July 2007 is similar to the flow patterns previously observed in the RI/FS.

4.0 ANALYTICAL RESULTS

Constituent concentration trends for point of compliance locations are presented in Section 4.1. The constituent concentration trends for other wells and springs are presented in Section 4.2. Time history charts for each location reviewed in this section are presented in Appendices A through H.

4.1 Constituent Concentration Trends in Point of Compliance Wells and Springs

The results of the analyses at the 2007 sample locations are presented in Table 7. This section summarizes the results for the groundwater point of compliance locations (PW-01, PW-02, PW-03, TW-20, TW-34, TW-35, TW-39, TW-53, TW-54, TW-55, and Harris well). Mormon A Spring and Mormon Creek are included for comparison against southern boundary wells and Soda Creek. Table 8 summarizes the constituent trends at these locations. The trends are based on a visual interpretation of data from 2002 through 2007. The next Five-Year Report will include a formal statistical analysis of the data.

4.1.1 Cadmium

The remediation goal for cadmium is 0.005 mg/L. Time-history plots of cadmium concentrations are included in Appendix A.

- **Production Wells** - Cadmium has decreased and stabilized, and is below the remediation goal in PW-03 (0.0014 mg/L). The cadmium concentration decreased below the remediation goal in PW-02 to 0.0035 mg/L in 2005, and is currently 0.0016 mg/L. Cadmium concentrations in PW-01 have generally decreased over time, but remain above the remediation goal at 0.0314 mg/L in 2007 (Figure A-1).
- **South Fence Line Wells** – In TW-20, cadmium decreased and stabilized below the remediation goal from 1998 to 2001, but shows an increasing trend from 2000 through 2006, when concentrations started to decrease. The concentration of cadmium in TW-20 in 2007 was 0.0068 mg/L, which exceeds the remediation goal. Cadmium is stable in TW-34 and TW-35 with non-detected concentrations (less than 0.0003 mg/L) in 2007 in both wells. Cadmium is generally stable in TW-39; however it is above the remediation goal with a concentration of 0.0093 mg/L in 2007 (Figure A-2).
- **Southern Boundary Wells** – Cadmium is below the remediation goal in wells TW-53, TW-54, and TW-55 and has been stable since 1995 (Figure A-3).
- **Mormon Spring and Harris Well** – Cadmium is stable at these two locations, and is below the remediation goal in Harris well (0.00032 mg/L). However, cadmium is above the remediation goal at Mormon A Spring with a 2007 concentration of 0.0174 mg/L (Figure A-4). Cadmium is below the detection limit (<0.0006 mg/L) in Mormon Creek at its confluence with Soda Creek in 2007.

4.1.2 Fluoride

The remediation goal for fluoride is 4 mg/L. Time-history plots of fluoride concentrations are included in Appendix B.

- **Production Wells** - Fluoride is below the remediation goal, and has remained stable at less than 2 mg/L in all three point of compliance production wells (PW-01, PW-02, and PW-03; Figure B-1).
- **South Fence Line Wells** – Fluoride has decreased since 1987 in TW-20, and has been below the remediation goal since 1998. Since 1998, fluoride concentrations have increased at TW-20. The fluoride concentration was 2.57 mg/L (average of sample and duplicate) in 2007, below the remediation goal. Fluoride is stable and below the remediation goal in TW-34 and TW-35. In TW-39, fluoride has been below the remediation goal since 2001 and decreased until 2005. The concentration of fluoride in 2007 at TW-39 increased from 2.05 mg/L in 2005 to 3.34 mg/L in 2007, but is less than the remediation goal of 4 mg/L (Figure B-2).
- **Southern Boundary Wells** – Fluoride in TW-53 is below the remediation goal and has decreased overall since 1999. The 2007 concentration is about 2.92 mg/L. Fluoride in TW-54 has been below the remediation goal since 2000. Fluoride concentrations increased slightly in TW-54 from about 2.6 mg/L in 2006 to 3.66 mg/L in 2007. Fluoride is stable at a concentration of about 0.26 mg/L and is below the remediation goal in TW-55 (Figure B-3).
- **Mormon Spring and Harris Well** – Fluoride has been below the remediation goal at the Harris well since 2001. Concentrations in 2007 are about 2.5 mg/L. Fluoride has been decreasing at Mormon Spring since 1996. In 2004, the fluoride concentration was 1.9 mg/L. In 2006, the concentration increased to 3.1 mg/L, and the 2007 concentration is similar (2.94 mg/L). In Mormon Creek, fluoride decreased from 1.96 mg/L in 2002 to 1 mg/L in 2004. In 2005, the concentration increased slightly to 1.62 mg/L, and in 2006 the concentration was 1.83 mg/L. The fluoride concentration increased in 2007 to 2.86 mg/L (Figure B-4).

4.1.3 Manganese

The remediation goal for manganese is 0.18 mg/L. As described in Golder 2003b, a temporary increase in manganese concentrations occurred in 2002 because of an increase of the detection limit from 0.01 to 0.06 mg/L for the 2002 sampling round. In all cases where manganese was not detected in 2002, 2003 manganese returned to levels similar to 2001 manganese levels. Time-history plots of manganese concentrations are included in Appendix C.

- **Production Wells** – In 2006, manganese was not detected (less than 0.0007 mg/L) in any of the production wells (Figure C-1).
- **South Fence Line Wells** – Manganese has decreased since the mid 1980's in TW-20 and TW-39, and has stabilized at or below the detection level (less than 0.0007 mg/L) since 1995. The concentration of manganese is stable in TW-35, with a 2007 concentration of 0.158 mg/L, below the remediation goal. The 2007 concentration of manganese in TW-34 (0.222 mg/L) exceeds the remediation goal (Figure C-2). It should be noted that TW-34 and TW-35 are completed in the transition zone between UBZ-2 and LBZ-2. Some sodic groundwater which naturally contains elevated manganese concentrations occurs in these wells due to the upward hydraulic gradient from the LBZ-2.
- **Southern Boundary Wells** – Manganese has been stable in the southern boundary wells since the mid 1990's, and is below the remediation goal in all wells. Concentrations in 2007 in the Southern Boundary Wells are all less than the detection limit (0.0007 mg/L; Figure C-3).

- **Mormon Spring and Harris Well** – Manganese has been stable at Mormon Spring and the Harris well, and is below the remediation goal at these locations. The manganese concentration at Mormon Creek is stable through 2006. In 2007, the manganese concentration is 0.0847 mg/L (Figure C-4)

4.1.4 Nitrate

The remediation goal for nitrate as N is 10 mg/L. Time-history plots of nitrate concentrations are included in Appendix D.

- **Production Wells** - Nitrate as N concentrations have stabilized at or below 4.5 mg/L and are below the remediation goal in all production wells (Figure D-1).
- **South Fence Line Wells** – In TW-20, nitrate as N concentrations decreased from 20.3 mg/L in 2006 to 10.95 mg/L in 2007 (average of sample and duplicate), slightly above the remediation goal. Nitrate as N is stable in TW-34 and TW-35 at concentrations below the remediation goal. The concentration of nitrate as N at TW-39 decreased from 12.2 mg/L in 2006 to 9.56 mg/L in 2007, below the remediation goal (Figure D-2).
- **Southern Boundary Wells** – Overall, nitrate as N has decreased in TW-53 since the mid 1990's. The 2007 nitrate as N concentration in TW-53 remains below the remediation goal, but increased from 5.01 mg/L in 2006 to 7.15 mg/L in 2007. In 2006, the concentration of nitrate as N in TW-54 increased above the remediation goal to 12.7 mg/L. In 2007, nitrate concentrations at TW-54 decreased to below the remediation goal (9.7 mg/L). Nitrate as N is slowly increasing but below the remediation goal in TW-55 with a 2007 concentration of 4.15 mg/L (Figure D-3).
- **Mormon Spring and Harris Wells** – Nitrate as N concentrations were stable at Mormon Spring between the mid 1990's and 2004 at about 6 to 7 mg/L. Nitrate as N increased to 9.5 mg/L and 9.3 mg/L in 2005 and 2006, respectively. The nitrate concentration in 2007 at Mormon Spring is similar at 9.22 mg/L. At the Harris well, nitrate as N concentrations have increased from 4.9 mg/L in 1999 to 8.96 mg/L in 2007. Concentrations of nitrate as N are below the remediation goal at both locations. The nitrate as N concentration in Mormon Creek is 5.62 mg/L in 2007 (Figure D-4).

4.1.5 Selenium

The remediation goal for selenium is 0.05 mg/L. Time-history plots of nitrate concentrations are included in Appendix E.

- **Production Wells** - Selenium has been stable and below the remediation goal in PW-02 and PW-03 since the early to mid 1990's. The selenium concentrations in PW-01 decreased from 0.053 mg/L in 2006 to 0.0167 mg/L in 2007, below the remediation goal (Figure E-1).
- **South Fence Line Wells** – Selenium at TW-20 increased from 0.03 mg/L in 2000 to 0.43 mg/L in 2005. In 2006, the concentration decreased to 0.077 mg/L, and the 2007 concentration of 0.0847 mg/L is similar and remains above the remediation goal. Selenium is stable in TW-34 and TW-35, with all observed selenium concentrations less than the remediation goal. Selenium increased in TW-39 from 2002 to 2005, but decreased in 2006 to 0.03 mg/L. In 2007, selenium concentrations increased in TW-39 to 0.125 mg/L, above the remediation goal (Figure E-1).

- **Southern Boundary Wells** – Selenium in TW-53 and TW-54 decreased from 2006 to 2007. Selenium in TW-53 decreased from 0.172 mg/L in 2006 to 0.115 mg/L in 2007. Selenium in TW-54 decreased from 0.333 mg/L in 2006 to 0.0849 mg/L in 2007. Selenium concentrations at these wells remain above the remediation goal. Concentrations decreased in TW-55 from a 2006 concentration of 0.115 mg/L, to 0.0413 mg/L in 2007, slightly below the remediation goal (Figure E-3).
- **Mormon Spring and Harris Wells** – Selenium in Mormon Spring is above the remediation goal, with a 2007 concentration of 0.136 mg/L, a decrease from the 2006 concentration of 0.29 mg/L. Selenium at the Harris well has been increasing since 2000, with a 2006 selenium concentration of 0.29 mg/L, above the remediation goal. In 2007, the concentration decreased to 0.123 mg/L. The selenium concentration in Mormon Creek has steadily increased from 0.07 mg/L in 2002 to 0.18 mg/L in 2006. In 2007, the selenium concentration at Mormon Creek decreased to 0.106 mg/L.

4.1.6 Chloride

There is no remediation goal for chloride at the site. Time-history plots of chloride concentrations are included in Appendix F.

- **Production Wells** - Chloride has increased since 2001 in PW-01 to about 99 mg/L in 2007. Chloride has slightly increased in PW-02 and PW-03 from about 30 mg/L in 2003 to about 50 to 60 mg/L (Figure F-1).
- **South Fence Line Wells** – Chloride increased in TW-20 from 55 mg/L in 2000 to 129 mg/L in 2006, and subsequently decreased to about 100 mg/L in 2007. Chloride is stable in TW-34, and TW-35, with 2007 concentrations at 39 mg/L, and 37 mg/L, respectively. Chloride has decreased in TW-39 since the early 1990's, with a 2007 concentration of 115 mg/L (Figure F-2).
- **Southern Boundary Wells** – Chloride has been increasing in TW-53, TW-54, and TW-55 since 1999. Chloride concentrations in these wells in 2007 are 111, 99, and 59 mg/L, respectively. Chloride is relatively stable in TW-56 at about 53 mg/L (Figure F-3).
- **Mormon Spring and Harris Wells** – Chloride at Mormon Spring appears to be stable since the early 1990's at about 100 mg/L. Chloride at Mormon Creek generally decreased since 2002, with a 2007 concentration of 171 mg/L. Chloride at the Harris well increased from 56 mg/L in 1999 to 121 mg/L in 2007 (Figure F-4).

4.1.7 Molybdenum

There is no remediation goal for molybdenum at the site. Time-history plots of molybdenum concentrations are included in Appendix G.

- **Production Wells** - Molybdenum is generally stable or increasing slightly in all production wells at concentrations less than 0.05 mg/L (Figure G-1).
- **South Fence Line Wells** – Molybdenum has increased since 2001 in TW-20; the 2007 concentration is 0.0537 mg/L. Molybdenum has been stable at 0.01 mg/L or less in TW-34 and TW-35 since 1994. In TW-39, molybdenum decreased between 1999 and 2006, with a 2006 concentration of 0.039 mg/L. The molybdenum concentration increased in 2007 to 0.062 mg/L (Figure G-2).

- **Southern Boundary Wells** – Molybdenum concentrations are all less than 0.1 mg/L in the southern boundary wells. Molybdenum increased in TW-53 from 1992 to 2000, but has been decreasing since 2000, with a 2007 concentration of 0.0581 mg/L. Molybdenum decreased in TW-54 between 1999 and 2005, but increased to 0.0896 mg/L in 2007. Molybdenum has been stable in TW-55 since 1999 (Figure G-3).
- **Mormon Spring and Harris Well** – Molybdenum has decreased since the late 1990s in Mormon Spring and the Harris Well, and is currently stable with concentrations below 0.1 mg/L. The 2007 molybdenum concentration in Mormon Creek is 0.0623 mg/L, increasing from the 2006 concentration of 0.033 mg/L (Figure G-4).

4.1.8 Sulfate

There is no remediation goal for sulfate at the site. Time-history plots of sulfate concentrations are included in Appendix H.

- **Production Wells** - Sulfate is stable in all production wells at concentrations less than 250 mg/L (Figure H-1).
- **South Fence Line Wells** – The sulfate concentration in TW-20 increased from 206 mg/L in 1999 to 918 mg/L in 2006. The sulfate concentration at TW-20 decreased to 552 mg/L in 2007. Sulfate has been stable at less than 250 mg/L in TW-34 and TW-35. Sulfate at TW-39 decreased between 2000 and 2004. Since 2005, the sulfate concentration at TW-39 has increased from 439 mg/L in 2005 to 527 mg/L in 2007 (Figure H-2).
- **Southern Boundary Wells** – Sulfate at TW-53 increased between 2000 and 2003. Concentrations in TW-53 decreased between 2004 and 2006, and increased from 260 mg/L in 2000 to a concentration of 472 mg/L in 2007. Sulfate concentrations in TW-54 increased from 170 mg/L in 2000 to 630 mg/L in 2006, and decreased to 492 mg/L in 2007. Sulfate has increased slightly in TW-55 from 117 mg/L in 2001 to 259 mg/L in 2007 (Figure H-3).
- **Mormon Spring and Harris Well** – Sulfate decreased in Mormon Spring between 1996 and 2004, but increased from 285 mg/L in 2004 to 509 mg/L in 2007. Sulfate has increased slightly in the Harris Well with a 2007 concentration of 553 mg/L. In Mormon Creek, sulfate increased to 400 mg/L in 2007, from a concentration of 302 mg/L in 2006 (Figure H-4).

4.2 Constituent Concentration Trends in Point of Compliance Surface Water

The results of the analyses at the 2007 sample locations are presented in Table 7. This section summarizes the results for the surface water point of compliance locations (Soda Creek downstream of the effluent discharge). Soda Creek upstream of the effluent discharge and the effluent discharge are included are included for comparison against Soda Creek downstream of the effluent discharge. Table 8 summarizes the constituent trends at these locations. The trends are based on a visual interpretation of data from 2002 through 2007.

4.2.1 Cadmium

The remediation goal for cadmium is 0.005 mg/L. Time-history plots of cadmium concentrations are included in Appendix A.

- **Soda Creek**—Cadmium upstream and downstream of the effluent discharge to Soda Creek has been stable since measurements began in 2001. Cadmium upstream and downstream of the discharge is undetected at less than 0.0006 mg/L (Figure A-5).
- **Effluent Discharge** – The 2007 average cadmium concentrations in the effluent discharge (sampled in triplicate) was 0.012 mg/L, slightly higher than the average 2006 concentration of 0.008 mg/L (Figure A-5).

4.2.2 Fluoride

The remediation goal for fluoride is 4 mg/L. Time-history plots of fluoride concentrations are included in Appendix B.

- **Soda Creek** - The 2007 concentrations were 0.51 mg/L (upstream) and 0.71 mg/L (downstream). The concentration at the weir below the effluent discharge was 0.47 mg/L in 2007 (Figure B-5).
- **Effluent Discharge** – The 2007 average fluoride concentration in the effluent discharge (sampled in triplicate) is 0.8 mg/L (Figure B-5).

4.2.3 Manganese

The remediation goal for manganese is 0.18 mg/L. As described in Golder 2003b, a temporary increase in manganese concentrations occurred in 2002 because of an increase of the detection limit from 0.01 to 0.06 mg/L for the 2002 sampling round. In all cases where manganese was not detected in 2002, 2003 manganese returned to levels similar to 2001 manganese levels. Time-history plots of manganese concentrations are included in Appendix C.

- **Soda Creek**— Manganese concentrations both upstream (0.125 mg/L) and downstream (0.114 mg/L) of the effluent discharge in Soda Creek as well as at the downstream weir (0.119 mg/L) are below the remediation goal. Manganese concentrations are increasing slowly in Soda Creek (Figure C-5).
- **Effluent Discharge** – Manganese concentrations are non-detect (less than 0.0007 mg/L) in the effluent discharge (Figure C-5).

4.2.4 Nitrate

The remediation goal for nitrate as N is 10 mg/L. Time-history plots of nitrate concentrations are included in Appendix D.

- **Soda Creek**—Nitrate as N concentrations are below the remediation goal both upstream and downstream of the effluent discharge with concentrations of 0.304 mg/L and 0.99 mg/L, respectively. The nitrate as N concentration of Soda Creek immediately upstream of the irrigation weir was 0.23 mg/L (Figure D-5).
- **Effluent Discharge** – The nitrate as N concentration in the effluent discharge is stable, ranging from 4.3 mg/L in 2000 to 4.48 mg/L in 2005. The 2007 average concentration was 4.05 mg/L (Figure D-5).

4.2.5 Selenium

The remediation goal for selenium is 0.05 mg/L. Time-history plots of selenium concentrations are included in Appendix E.

- **Soda Creek** — Selenium was detected in Soda Creek upstream of the effluent discharge at a concentration of 0.00042 mg/L. Downstream of the discharge, selenium has been stable since 2001, with a 2007 concentration of 0.0112 mg/L. Selenium was detected at 0.001 mg/L in Soda Creek immediately upstream of the irrigation weir in 2007 (Figure E-5).
- **Effluent Discharge** – Selenium concentration in the effluent discharge has been stable since 2000, with a 2007 concentration of 0.0127 mg/L (average of three duplicate samples; Figure E-5).

4.2.6 Chloride

There is no remediation goal for chloride at the site. Time-history plots of chloride concentrations are included in Appendix F.

- **Soda Creek** — Concentrations at the upstream and downstream locations were 10.1 mg/L and 43.3 mg/L, respectively in 2007. The chloride concentration of Soda Creek immediately upstream of the irrigation weir was 14.2 mg/L (Figure F-5).
- **Effluent Discharge** – Chloride in the effluent discharge decreased from around 300 mg/L in 2001 to 210 mg/L in 2007 (Figure F-5).

4.2.7 Molybdenum

There is no remediation goal for molybdenum at the site. Time-history plots of molybdenum concentrations are included in Appendix G.

- **Soda Creek** — Concentrations in 2007 at the upstream and downstream locations on Soda Creek were 0.0126 mg/L and 0.0294 mg/L, respectively. The molybdenum concentration of Soda Creek immediately upstream of the irrigation weir was 0.0138 mg/L (Figure G-5).
- **Effluent Discharge** – Molybdenum concentrations in the effluent discharge were 0.0388 mg/L (average of three samples) in 2007 (Figure G-5).

4.2.8 Sulfate

There is no remediation goal for sulfate at the site. Time-history plots of sulfate concentrations are included in Appendix H.

- **Soda Creek** — Concentrations of sulfate were 21.6 mg/L and 53.9 mg/L, respectively, upstream and downstream of the effluent discharge in 2007. The sulfate concentration at the downstream weir was 26.3 mg/L in 2007 (Figure H-5).
- **Effluent Discharge** – The sulfate concentration in the effluent discharge has been stable since 2000. The 2007 concentration was 122 mg/L (Figure H-5).

4.3 Constituent Concentration Trends in Other Wells and Springs

This section summarizes water quality monitoring at six locations at the Plant site and south of the Plant. They are the NW pond (TW-16, TW-17, and TW-18), the old UFS ponds area (TW-22, TW-24, TW-37, and TW-45), the UFS piles area (TW-48, TW-49, and TW-50), the old hydroclarifier area (TW-40, TW-43 and TW-44), springs to the southwest of the Plant (Homestead and Mormon springs), and the new monitoring wells to the south of the Plant (TW-59, TW-60, TW-61, and TW-62). Table 9 summarizes the constituent trends at these wells and springs, except for the new wells where only one year of data are available. The trends are based on a visual interpretation of data from 2002 through 2007. The next Five-Year Report will include a formal statistical analysis of the data.

4.3.1 Cadmium

Time-history plots of cadmium concentrations are included in Appendix A.

- **Northwest Pond Area** - Cadmium has stabilized at wells TW-16, TW-17, and TW-18 with 2007 concentrations of 0.513 mg/L, 0.0015 mg/L, and non-detect (less than 0.0006 mg/L), respectively (Figure A-6).
- **Old Underflow Solids Ponds Area** – Cadmium in the wells near the old UFS ponds have remained relatively stable (with the exception of TW-37, which shows a slight increase). The 2007 concentrations in the UBZ wells in this area (TW-22, TW-24, and TW-37) are 0.0234 mg/L, 0.244 mg/L and 0.577 mg/L, respectively. In TW-45, which is completed in the LBZ, cadmium concentrations have been stable since 1994 with a concentration of 0.002 mg/L in 2007 (Figure A-7).
- **Underflow Solids Piles Area** – Since 2004, cadmium has been below the detection limit (0.002 to 0.0003 mg/L) in TW-48. In TW-50, the cadmium concentration increased from non-detect in 2001 to 0.031 mg/L in 2005. In 2007, cadmium decreased in TW-50 to 0.0077 mg/L. Cadmium is stable in TW-49 with concentrations below the detection limit (Figure A-8).
- **Hydroclarifier Area** – Cadmium has been relatively stable in TW-40 since 2001 and has shown an overall decrease since 1998. During the 2007 sampling round, cadmium in TW-40 was 2.41 mg/L, a slight increase from the 2006 concentration of 2.22 mg/L. Cadmium is stable in TW-43 with a 2006 concentration of 1.74 mg/L. Cadmium was not detected in TW-44 in 2007 (Figure A-9).
- **South of the Plant Springs** – Cadmium has not been detected in Homestead Spring since sampling began at this location in 1991. Cadmium concentrations at Mormon Spring have been relatively stable between 1998 and 2004, when they started to increase slightly. In 2007, the cadmium concentration is 0.0174 mg/L (Figure A-14).
- **2007 Monitoring Wells** – Cadmium was not detected in the new wells (Figure A-15).

4.3.2 Fluoride

Time-history plots of fluoride concentrations are included in Appendix B.

- **Northwest Pond Area** - Fluoride has decreased gradually in TW-16 and TW-17 since the early 1990's, with 2007 concentrations of 2.16 mg/L and 2.39 mg/L, respectively. In TW-18, fluoride has been stable with all concentrations at 0.5 mg/L or less (Figure B-6).

- **Old Underflow Solids Ponds Area** – Concentrations decreased in TW-22 from 1997 to 2005. Concentrations increased slightly since 2005 to about 4.17 in 2007 mg/L. At TW-24, concentrations in 2009 were 5.95 mg/L, up from 5.0 mg/L in 2004. Fluoride is decreasing slowly in TW-37 and TW-45 with concentrations of 9.77 mg/L and 0.93 mg/L, respectively in 2007 (Figure B-7).
- **Underflow Solids Piles Area** – Fluoride is stable in TW-48, TW-49, and TW-50 with concentrations less than about 1 mg/L (Figure B-8).
- **Hydroclarifier Area** – Fluoride concentrations at TW-40 and TW-43 appear stable with 2006 concentrations of 4.65 mg/L and 5.16 mg/L, respectively. Fluoride concentrations are stable at TW-44 at less than 1.0 mg/L through 2007, with the single exception of the 2000 fluoride concentration (1.4 mg/L; Figure B-9).
- **South of the Plant Springs** - Fluoride concentrations are stable at Homestead Spring, with concentrations below 1.0 mg/L. Fluoride decreased at Mormon Spring from 1996 (5.9 mg/L) to in 2004 (1.9 mg/L). In 2005 and 2006, the concentrations were 2.3 mg/L and 3.1 mg/L, respectively. The 2007 concentration was 2.94 mg/L (Figure B-14).
- **2007 Monitoring Wells** – Fluoride was not detected in new wells TW-59, TW-60, and TW-61. Fluoride was detected at 0.22 mg/L in TW-62 (Figure B-15).

4.3.3 Manganese

Time-history plots of manganese concentrations are included in Appendix C.

- **Northwest Pond Area** - Manganese is stable at TW-16 at non-detected concentrations (less than 0.0007 mg/L). Manganese is increasing at TW-17 with a 2007 concentration of 2.55 mg/L. In TW-18, manganese is stable with a 2007 concentration of 0.40 mg/L (Figure C-6).
- **Old Underflow Solids Ponds Area** – Manganese is stable or decreasing slightly in TW-22 at 0.786 mg/L. Manganese is stable at TW-24 and TW-37 with 2007 concentrations of 0.199 mg/L and 0.589 mg/L, respectively. In TW-45, manganese is stable or decreasing slightly with a 2007 concentration of 0.432 mg/L (Figure C-7).
- **Underflow Solids Piles Area** – In TW-48, manganese concentrations are stable. The 2007 manganese concentration in TW-48 was 0.0025 mg/L. Manganese is stable in TW-49 and TW-50 with 2007 concentrations non-detected (less than 0.0007 mg/L) and 0.489 mg/L, respectively (Figure C-8).
- **Hydroclarifier Area** - Manganese appears stable in TW-40, TW-43, and TW-44 with 2006 concentrations at 0.0365 mg/L, 0.0091 mg/L and 0.22 mg/L, respectively (Figure C-9).
- **South of the Plant Springs** - Manganese concentrations are stable at Homestead and Mormon Springs with 2007 non-detected concentrations of less than 0.0007 mg/L and less than 0.0009 mg/L, respectively (Figure C-14).
- **2007 Monitoring Wells** – Manganese was detected in three of the new wells. The 2007 manganese concentrations in wells TW-59, TW-50, TW-61, and TW-62 are less than 0.0007 mg/L, 6.04 mg/L, 0.493 mg/L, and 0.0039 mg/L, respectively (Figure C-15). The concentrations of 0.493 mg/L in TW-61 and 6.08 mg/L in TW-60 indicate the effects of sodic groundwater in these wells (Golder 2007). Sodic groundwater typically has higher

manganese concentrations than fresh groundwater, and has been observed in other UBZ wells in the southwest corner of the plant (Golder 1995).

4.3.4 Nitrate

Time-history plots of nitrate concentrations are included in Appendix D.

- **Northwest Pond Area** - Nitrate as N decreased at TW-16 between 1997 and 2004. The nitrate as N concentration increased in 2005 to 5.9 mg/L and 6.91 mg/L in 2006, and decreased slightly in 2007 to 6.38 mg/L. Nitrate is stable in TW-17 and TW-18 with 2007 concentrations at both wells of less than 0.02 mg/L (Figure D-6).
- **Old Underflow Solids Ponds Area** – At TW-22 and TW-24, nitrate concentrations are less than 10 mg/L. Nitrate concentrations in TW-22 have decreased since 1999, with a 2007 concentration of 4.63 mg/L. In TW-24, the nitrate concentration decreased between 2000 and 2004, but increased slightly in 2005 and 2006 with concentrations of 6.2 mg/L and 6.23 mg/L, respectively. Nitrate concentrations decreased slightly in TW-24 to 6.06 mg/L in 2007. Nitrate appears to be increasing in TW-37, with a 2007 concentration of 10.8 mg/L (Figure D-7). The nitrate concentration in TW-45 is stable with a 2007 concentration of less than 0.02 mg/L (Figure D-10).
- **Underflow Solids Piles Area** – In TW-48, nitrate concentrations have increased since 2004 from 3.94 mg/L to 5.85 mg/L in 2006. Nitrate concentrations decreased slightly in TW-48 to 5.1 mg/L in 2007. Nitrate has been stable in TW-49 and TW-50 with 2007 concentrations less than 4 mg/L (Figure D-8).
- **Hydroclarifier Area** – Nitrate concentrations in TW-43 have increased since the mid-1990's to a 2007 concentration of 13.2 mg/L. The nitrate concentration in TW-40 has similarly increased since the late 1990's. The TW-40 nitrate concentration in 2007 is 16.2 mg/L. In TW-44, nitrate currently appears relatively stable with a 2007 concentration of less than 0.02 mg/L (Figure D-9).
- **South of the Plant Springs** – Nitrate concentrations have increased since 2001 in Homestead Spring, with a 2007 concentration of 14.3 mg/L. Nitrate in Mormon spring increased between 2004 (6.7 mg/L) and 2007 (9.22 mg/L).
- **2007 Monitoring Wells** – Nitrate was detected in three of the new wells installed south of the Southern Boundary Wells. The 2007 concentrations are 5.76 mg/L (TW-59), 0.042 mg/L (TW-61) and 5.00 mg/L (TW-62). Nitrate was not detected in TW-60.

4.3.5 Selenium

Time-history plots of nitrate concentrations are included in Appendix E.

- **Northwest Pond Area** – Selenium decreased in TW-16 from 0.21 mg/L in 2006 to 0.0056 mg/L in 2007. Selenium is stable in TW-17 and TW-18 at 2007 concentrations of 0.0024, mg/L and 0.0002 mg/L, respectively (Figure E-6).
- **Old Underflow Solids Ponds Area** – Selenium decreased at TW-22 from 0.282 mg/L in 2006 to 0.105 mg/L in 2007. In TW-24, selenium decreased by an order of magnitude from 2005 to 2006. This "decrease" represents an anomalous value. In 2007, the selenium concentration at TW-24 is 0.171 mg/L, slightly lower than previously observed range of 0.2 to 0.5 mg/L (excluding 2006). Selenium has been stable between 1996 and

2006 in TW-37 with a 2006 concentration of 0.5 mg/L. In 2007, the selenium concentration decreased to 0.162 mg/L. In TW-45, selenium is stable with a 2007 concentration of 0.0003 mg/L (Figure E-7).

- **Underflow Solids Piles Area** – Selenium is stable at TW-48 and TW-49 with 2006 concentrations of 0.0009 mg/L and 0.0015 mg/L, respectively. The selenium concentration in TW-50 increased from 0.029 mg/L in 2003 to 0.33 mg/L in 2004. In 2005 and 2006, the selenium concentrations in TW-50 were 0.045 mg/L and 0.053 mg/L, respectively, indicating the 2004 concentration was anomalous. The 2007 concentration of selenium at TW-50 is 0.0191 mg/L (Figure E-8).
- **Hydroclarifier Area** – Selenium increased in TW-43 from the mid 1990's to 2006 (1.06 mg/L). In 2007, the selenium concentration decreased to 0.343 mg/L. Selenium concentrations in TW-40 have declined from 2003 to 2007. In 2007, the selenium concentration in TW-40 is 0.282 mg/L. Selenium appears relatively stable in TW-44 with concentrations of mostly non-detects (less than 0.003 mg/L) throughout the monitoring period (Figure E-9).
- **South of the Plant Springs** - Selenium concentrations are stable at Homestead Spring with a 2007 concentration of 0.0071 mg/L. From the mid 1990's to 2006, selenium concentrations were slowly increasing at Mormon Springs with a concentration of 0.294 mg/L in 2006. In 2007, the selenium concentration at Mormon Springs decreased to 0.136 mg/L (Figure E-14).
- **2007 Monitoring Wells** – Selenium was detected in the new wells installed south of the Southern Boundary Wells. The 2007 concentrations are 0.0321 (TW-59), 0.00037 mg/L (TW-60), 0.00057 mg/L (TW-61) and 0.0456 mg/L (TW-62; Figure E-15).

4.3.6 Chloride

Time-history plots of chloride concentrations are included in Appendix F.

- **Northwest Pond Area** – In the last three years, chloride has increased in TW-16 from 39.9 mg/L in 2004 to 78 mg/L in 2007. The concentration of chloride in TW-17 is decreasing, with a concentration of 125 mg/L in 2007. Chloride is stable in TW-18 with a concentration in 2007 of 15 mg/L (Figure F-6).
- **Old Underflow Solids Ponds Area** – Chloride is stable at TW-22 and TW-45 with 2006 concentrations of than 50 mg/L. In TW-24, the chloride concentration decreased from 2005 (142 mg/L) to 2007 (48 mg/L). From 2004 to 2006, the concentration of chloride increased TW-37 from 36 mg/L to 139 mg/L. In 2007, the chloride concentration in TW-37 is 130 mg/L (Figure F-7).
- **Underflow Solids Piles Area** – Chloride is stable in TW-48 and TW-49 with concentrations less than 50 mg/L. Chloride has been slowly increasing in TW-50 since 1999. The 2007 chloride concentration in TW-50 was 190 mg/L (Figure F-8).
- **Hydroclarifier Area** –Chloride is stable in TW-43 with a 2007 concentration of 278 mg/L. The chloride concentration in TW-40 decreased to 369 mg/L in 2007 from 473 mg/L in 2005. Chloride has been stable in TW-44 throughout the monitoring period with a 2007 concentration of 27 mg/L (Figure F-9).
- **South of the Plant Springs** - Chloride is stable in Mormon Spring at about 120 mg/L in 2007. Chloride in Homestead Spring is stable at 28 mg/L (Figure F-14).

- **2007 Monitoring Wells** – Chloride was detected in the new wells installed south of the Southern Boundary Wells. The 2007 concentrations are 203 mg/L (TW-59), 68.2 mg/L (TW-60), 95.6 mg/L (TW-61) and 209 mg/L (TW-62; Figure F-15).

4.3.7 Molybdenum

Time-history plots of molybdenum concentrations are included in Appendix G.

- **Northwest Pond Area** - Molybdenum is stable in TW-16 and TW-17 at concentrations less than 0.05 mg/L. In TW-18, the molybdenum concentration was 0.015 mg/L in 2007 (Figure G-6).
- **Old Underflow Solids Ponds Area** – The molybdenum concentration is decreasing in TW-22 with a 2007 concentration of 0.328 mg/L. In TW-24, the molybdenum concentration increased to 0.83 mg/L in 2005, after decreasing between 1997 and 2004. The concentration in TW-24 decreased to 0.57 mg/L in 2006 and 0.431 mg/L in 2007. Molybdenum is stable in TW-37 with concentrations less than 0.5 mg/L since 1997. Molybdenum is stable at TW-45 with concentrations below 0.05 mg/L since 1992 (Figure G-7).
- **Underflow Solids Piles Area** – Molybdenum is stable and has remained less than 0.05 mg/L since 1993 in TW-48 and TW-49. At TW-50, molybdenum has decreased from 0.062 mg/L in 2003 to 0.0461 mg/L in 2007 (Figure G-8).
- **Hydroclarifier Area** – Molybdenum is stable at TW-43 and TW-40 with concentrations less than 0.20 mg/L since 1993. Molybdenum is stable at TW-44 at less than 0.05 mg/L (Figure G-9).
- **South of the Plant Springs** - Molybdenum is stable at Homestead Spring with a concentration of 0.0155 mg/L in 2007. Mormon Spring has stable molybdenum concentrations, with a 2007 concentration of 0.0757 mg/L (Figure G-14).
- **2007 Monitoring Wells** – Molybdenum was detected in the new wells installed south of the Southern Boundary Wells. The 2007 concentrations are 0.0141 mg/L (TW-59), 0.0163 mg/L (TW-60), 0.0119 mg/L (TW-61) and 0.018 mg/L (TW-62; figure G-15).

4.3.8 Sulfate

Time-history plots of sulfate concentrations are included in Appendix H.

- **Northwest Pond Area** - Sulfate is stable at TW-16, TW-17, and TW-18 at concentrations less than 250 mg/L (Figure H-6).
- **Old Underflow Solids Ponds Area** – Sulfate has decreased since 1998 at TW-22 with a 2007 concentration of 148 mg/L. The sulfate concentration in TW-24 increased from 156 mg/L in 2004 to 327 mg/L in 2005. In 2006, the concentration of sulfate in TW-24 slightly decreased to 315 mg/L. In 2007, the decrease in concentrations continued, with a 2007 concentration of 189 mg/L. Sulfate appears to be increasing in TW-37 since 2002, with a 2007 concentration of 407 mg/L. In TW-45, sulfate is stable with a concentration of 120 mg/L in 2006 (Figure H-7).
- **Underflow Solids Piles Area** – Sulfate is stable and typically below 100 mg/L in TW-48 and TW-49. Sulfate is slowly increasing in TW-0 with a 2007 concentration of 337 mg/L in 2007 (Figure H-8).

- **Hydroclarifier Area** – Sulfate was decreasing prior to 1993 in TW-43, and was not measured again until 2002. Sulfate increased from 261 mg/L in 1993 to 639 mg/L 2003. Since 2003, the sulfate concentration has been stable. The 2007 sulfate concentration in TW-43 was 604 mg/L. In TW-40, sulfate concentrations decreased between 1999 and 2003. In 2005 and 2006, sulfate concentrations increased from the 2003 concentration of 555 mg/L to 758 mg/L (2005) and 736 mg/L (2006). The 2007 sulfate concentration was 696 mg/L. Sulfate is stable at TW-44 with a 2006 concentration of 90 mg/L (figure H-9).
- **South of the Plant Springs** – The sulfate concentration at Mormon Spring has increased from 285 mg/L in 2004 to 509 mg/L in 2007. Sulfate is stable at Homestead Spring with a 2006 concentration of 87 mg/L (Figure H-14).
- **2007 Monitoring Wells** – Sulfate was detected in the new wells installed south of the Southern Boundary Wells. The 2007 concentrations are 255 mg/L (TW-59), 70 mg/L (TW-60), 98 mg/L (TW-61) and 319 mg/L (TW-62; Figure H-15).

5.0 OVERALL ASSESSMENT

This section summarizes the remediation goals at the Monsanto Plant site and trends in constituent concentrations.

5.1 Remediation Goals

The following is a summary of the remediation goals for the point of compliance locations (wells and surface water) located at the southern boundary or south of the Monsanto Plant. Table 10 provides a summary of the results from all point of compliance locations compared to corresponding remediation goals.

- Cadmium is below the remediation goal of 0.005 mg/L in the point of compliance locations except PW-01, TW-20, and TW-39. The 2007 cadmium concentrations in PW-01, TW-20, and TW-39 are 0.0314 mg/L, 0.0068 mg/L, and 0.0093 mg/L, respectively.
- Fluoride is below the remediation goal of 4 mg/L in all point of compliance locations.
- Manganese is at or below the remediation goal of 0.18 mg/L in all point of locations except for TW-34 (0.222 mg/L). Well TW-34 is a sodic water well that has naturally-occurring high manganese concentrations.
- Nitrate as N is below the remediation goal of 10 mg/L in all point of locations except TW-20 (10.5 mg/L).
- Selenium is below the remediation goal of 0.05 mg/L in point of compliance wells PW-02, PW-03, PW-04, TW-34, TW-35, TW-55, and in Soda Creek. Selenium exceeds the remediation goal of 0.05 mg/L in point of compliance wells TW-20 (0.0847 mg/L), TW-39 (0.125 mg/L), TW-53 (0.115 mg/L), TW-54 (0.0849 mg/L), and the Harris Well (0.123 mg/L).

5.2 Constituent Trends

Constituent trends are based on a visual interpretation of data from 2002 through 2007. The next Five-Year Report will include a formal statistical analysis of the data.

5.2.1 Point of Compliance Locations

Constituents of concern are stable or decreasing at point of compliance locations with the following exceptions:

- Fluoride is increasing in TW-20 and TW-39, located on the Plant Fence Line. In TW-20, fluoride concentrations increased from 2004 (1.67 mg/L) to 2007 (2.57 mg/L). In TW-39, fluoride concentrations increased from 2004 (1.96 mg/L) to 2007 (3.34 mg/L).
- Nitrate as N is increasing in TW-20 and TW-39 at the Plant Fence Line, in Southern Boundary Wells TW-53, TW-54, and TW-55, in the Harris Well, and in Mormon A Spring. In TW-20 nitrate as N increased from 2001 (4.57 mg/L) to 2007 (10.95 mg/L). In TW-39, nitrate increased from 4.2 mg/L in 2004 to 9.56 mg/L in 2007. Nitrate increased from 4.5 mg/L in 2001 to 7.15 mg/L in 2007 in TW-53, and increased from 1.0 mg/L in 2002 to 9.7 mg/L in 2007. In TW-55, nitrate increased from 2003 (2.58 mg/L) to 2007 (4.15 mg/L). In the Harris well, nitrate increased from 4.9 mg/L in

1999 to 8.96 mg/L in 2007, and in Mormon A Spring, nitrate increased from 2002 (5.95 mg/L) to 2007 (9.22 mg/L).

- Selenium is increasing in TW-55 (Southern Boundary Well). Selenium increased from 2001 (0.013 mg/L) to 2006 (0.115 mg/L). In 2007, the selenium concentration decreased to 0.0413 mg/L.

Other constituents are stable or decreasing at the point of compliance wells with the following exceptions:

- Chloride is increasing slightly in the plant production wells (PW-01, PW-02, and PW-03), TW-55 (Southern Boundary Well), the Harris Well, and Mormon A Spring.
- Molybdenum is increasing in Plant Production Wells PW-01, PW-02, and PW-03, in TW-20 at the Plant Fence Line, in TW-54 (Southern Boundary Well, and in Mormon A Spring.
- Sulfate is increasing in TW-20 and TW-39 at the Plant Fence Line, Southern Boundary Wells TW-53 and TW-55, in the Harris Well, and in Mormon A Spring.

5.2.2 Other Locations

Constituents of concern are stable or decreasing at the other sampling locations with the following exceptions:

- Cadmium increased in TW-37 at the old UFS Ponds from 2002 (0.326 mg/L) to 2007 (0.577 mg/L). Cadmium also increased in Mormon A Spring from 2005 (0.0115 mg/L) to 2007 (0.0174 mg/L).
- Fluoride increased in TW-24 at the old UFS Ponds from 4.99 mg/L in 2004 to 5.95 mg/L in 2007.
- Manganese increased in TW-17 (Northwest Pond) from 0.24 mg/L in 1984 to 2.55 mg/L in 2007. Manganese also increased in TW-50 (UFS Piles) from 2000 (0.0004 mg/L) to 2007 (0.0077 mg/L).
- Nitrate as N increased in TW-16 (NW Pond), TW-24 and TW-37 (Old UFS Ponds), TW-48 (UFS Piles), TW-40 (Old Hydroclarifier), the Harris Well, and Mormon A Spring.

Other constituents are stable or decreasing at all of the other sampling locations with the following exceptions:

- Chloride is increasing in TW-16 (NW Pond), TW-29 (Background), TW-24 and TW-37 (Old UFS Ponds), TW-50 (UFS Piles), and in TW-40 (Old Hydroclarifier).
- Molybdenum is increasing in Mormon A Spring.
- Sulfate is increasing in TW-40 and TW-44 (Old Hydroclarifier), TW-50 (UFS Piles) and Mormon A Spring.

5.3 Assessment of 2007 Water Quality Data

The groundwater elevation data indicate that pumping at the plant production wells (PW-1, PW-2, and PW-3) has contained the plume from the northwest pond and the old hydroclarifier areas in UBZ-4.

In UBZ-1 and UBZ-2, sulfate concentrations were increasing in the 1990's in the old UFS ponds and the old hydroclarifier areas, but are currently stable or decreasing with the exception of sulfate in TW-TW-37 at the old UFS pond, which has increased since about 2002. The concentrations of "mobile" constituents such as chloride, fluoride, and nitrate are generally stable or decreasing, as expected, in the wells at the plant fence line, the southern boundary, and the springs. However, concentrations of "mobile" constituents of concern (nitrate and fluoride) appear to be increasing in the fence line wells (TW-20 and TW-39), southern boundary wells (TW-53 and TW-55) and certain springs (e.g. Mormon A Spring and Homestead Spring). Sulfate and chloride also appear to be increasing in these wells.

Concentrations of metals generally show a stable or downward trend for constituents of concern manganese, selenium, and cadmium with a few exceptions. An upward trend in selenium is occurring in southern boundary well TW-55 and in Soda Creek. An upward trend in cadmium is occurring in Mormon A Spring. Molybdenum is increasing in the Plant Production Wells, TW-20, TW-54, and Mormon A Spring.

Chemical isopleth maps for cadmium and selenium shown on Figures 7 and 8, respectively, indicate the plume from the old UFS ponds in UBZ-2 has extended beyond the southern boundary wells and is migrating towards Soda Creek.

5.4 2007 Monitoring Wells

Four new monitoring wells (2007 Monitoring Wells) were installed south of the Southern Boundary Wells (Golder 2007) to evaluate groundwater conditions and groundwater quality in the areas south of the Plant, and to delineate the southern extent of groundwater plumes in the UBZ-1 and UBZ-2 zones.

The new wells indicated the following:

- Concentrations of constituents of concern were below the remediation goals in all of the new monitoring wells.

- Groundwater quality in the two wells on the east side of Government Dam Road, TW-60 and TW-61 (Figure 2), appear to be influenced by sodic groundwater. In particular, elevated concentrations of bicarbonate, manganese, total dissolved solids, and calcium and low concentrations of nitrate are indicative of sodic groundwater in these wells (Golder 1995).

- Groundwater in the two wells on the east side of Government Dam Road, TW-59 and TW-62 (Figure 2) appears to be impacted by the groundwater plume in UBZ-2. Groundwater from these wells contains slightly elevated concentrations of selenium, nitrate, chloride, and sulfate. Concentrations of nitrate and selenium are below the Remediation Goals.

- The new monitoring wells provide data to delineate the southern boundary of affected groundwater that exceeds the remediation goals.

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TABLES

TABLE 1

Well Completion Summary

Well	Formation	Measuring Point (MP) (per RI Report)	MP Elevation	Top of Monitored Interval (feet bgs)	Bottom of Monitored Interval (feet bgs)	Hole Diameter (inches)	Casing Diameter (inches)	SP Northing	SP Easting	Comment
HARRIS	UBZ	Top of steel 1" pipe	5,877.56	58.0	62.0	6	6	368,317.50	654,651.32	MP = 4.05' above well-house floor
TW-08	UBZ	Top of PVC well cap	5,884.88	76.24	91.2	8	4	369,003.99	654,360.29	Top of PVC well cap
TW-10	UBZ	Top of seal	5,885.53	19.56	25.6	8	4	368,989.74	654,367.10	Top of seal = 0.05' above TOC
TW-11	LBZ	Top of coupling	5,938.03	129.12	138.5	8	4	368,986.08	656,682.08	Top of coupling = 0.25' above TOC
TW-12	UBZ	Top of seal	5,939.23	88.55	103.8	8	4	369,017.37	656,681.35	Top of seal = 0.07' above TOC
TW-15	UBZ	Top of seal	5,988.27	50.39	62.4	8	4	374,947.60	658,454.43	Top of seal = 0.04' above TOC
TW-16	UBZ	Top of seal	5,998.39	69.13	78.6	8	4	374,541.55	654,567.41	Top of seal = 0.04' above TOC
TW-17	UBZ	Top of seal	5,998.53	98.5	117.5	8	4	374,539.37	654,587.61	Top of seal = 0.04' above TOC
TW-18	LBZ	Top of seal	5,996.89	221.75	240.8	8	4	374,520.88	654,587.13	Top of seal = 0.04' above TOC
TW-20	UBZ	Top of seal	5,893.37	38.15	46.4	8	4	368,975.43	655,503.64	Top of seal = 0.05' above TOC
TW-22	UBZ	Top of seal	5,954.70	105.36	114.3	8	4	371,421.14	654,280.62	Top of seal = 0.05' above TOC
TW-24	UBZ	Top of PVC casing	5,954.43	75.3	94.3	8	4	371,435.86	654,273.24	
TW-26	UBZ	Top of seal	5,991.42	138.99	145	8	4	372,217.87	655,264.35	Top of seal = 0.04' above TOC
TW-29	UBZ	Top of coupling	5,989.59	42.68	49.7	10	4	375,477.82	654,187.34	Top of coupling = 0.27' above TOC
TW-30	UBZ	Top of coupling	5,992.73	64.69	71.7	8	4	373,594.42	655,794.00	Top of coupling = 0.25' above TOC
TW-33	UBZ	Top of coupling	5,975.68	69.11	77.1	8	4	372,526.92	657,699.47	Top of seal = 0.07' above TOC
TW-34	UBZ	Top of coupling	5,893.43	69.92	76.4	8	4	368,993.91	655,496.74	Top of coupling = 0.27' above TOC
TW-35	UBZ	Top of seal	5,897.16	73.53	86	8	4	369,036.29	655,076.56	Top of seal = 0.04' above TOC
TW-37	UBZ	Top of seal	5,959.17	96.32	102.9	8	4	372,837.18	654,245.63	Top of seal = 0.03' above TOC
TW-38	UBZ	Top of PVC casing	5,972.91	92.72	104.7	8	4	370,446.40	656,523.94	
TW-39	UBZ	Top of seal	5,897.07	50.57	58.1	8	4	369,036.99	655,061.98	Top of seal = 0.04' above TOC
TW-40	UBZ	Top of PVC casing	5,989.94	84.32	91.3	8	4	373,122.39	655,757.09	
TW-41	UBZ	Top of coupling	5,994.31	57.86	70.9	8	4	373,505.54	655,621.80	Top of coupling = 0.3' above TOC
TW-43	UBZ	Top of PVC casing	5,959.08	82.38	91.4	8	4	373,141.22	655,697.28	Pump out of well
TW-44A	LBZ	Top of seal	5,959.41	131	150	8	4	373,110.02	655,766.66	Top of seal = 0.04' above TOC
TW-45	UBZ	Top of coupling	5,959.17	216.79	230.8	8	4	372,827.62	654,238.16	Top of coupling = 0.26' above TOC
TW-48	UBZ	Top of coupling	5,959.40	67.31	73.3	8	4	375,520.55	655,978.20	Top of coupling = 0.25' above TOC
TW-49	UBZ	Top of seal	5,996.94	75.21	84.2	8	4	374,930.77	656,071.52	Top of seal = 0.04' above TOC
TW-50	UBZ	Top of seal	5,992.94	73.78	90.8	8	4	373,849.68	656,040.74	Top of seal = 0.04' above TOC
TW-53	UBZ	Top of coupling	5,850.65	19.54	34	8	4	368,055.24	654,739.84	Top of coupling = 0.26' above TOC
TW-54	UBZ	Top of coupling	5,859.21	39.26	54.3	8	4	368,052.39	655,240.52	Top of coupling = 0.25' above TOC
TW-55	UBZ	Top of coupling	5,856.58	52.5	69	8	4	368,050.24	655,739.76	Top of coupling = 0.25' above TOC
TW-56	UBZ	Top of coupling	5,910.20	86.8	100.3	8	4	367,979.10	656,276.06	Top of coupling = 0.2' above TOC
TW-57	UBZ	Top of coupling	5,952.74	22.18	37.3	8	4	374,365.91	654,000.20	Top of coupling = 0.2' above TOC
TW-58	UBZ	Top of Casing	5,892.74	36.3	51.7	12	8	368,980.16	655,458.20	
TW-59	UBZ	Top of coupling	5,858.64	29	42.5	8	4	365,662.80	654,853.50	Top of coupling = 0.17' above TOC
TW-60	UBZ	Top of coupling	5,859.42	43	56	8	4	366,126.70	653,945.10	Top of coupling = flush with TOC
TW-61	UBZ	Top of coupling	5,878.75	61.5	77	8	4	367,105.20	653,904.70	Top of coupling = 0.38' above TOC
TW-62	UBZ	Top of coupling	5,851.31	46.6	62.5	8	4	366,945.50	655,320.40	Top of coupling = 0.22' above TOC
SO2 Landfill North	UBZ	Top of coupling	TBD	68	88	8	4	TBD	TBD	
SO2 Landfill South	UBZ	Top of coupling	TBD	60	80	8	4	TBD	TBD	

TBD, To be determined

History of Groundwater Investigations at Monsanto Plant

Date	Activity	Conducted By/For	Description
1978	Monsanto well installation	Monsanto	Installed 5 groundwater monitoring wells
1982	Monsanto well installation	Monsanto	Installed 2 additional wells, initiated spring sampling
1984	Groundwater Investigation	Golder/Monsanto	Installed 31 groundwater monitoring wells, characterized constituent plumes, identified sources of constituents
1988	CERCLA Site Inspection	Ecology & Environment/EPA	Groundwater sampling and analysis
1991 to 1998	Bi-annual groundwater monitoring	Golder/ Monsanto	Monsanto samples between 50 and 60 monitoring wells, offsite wells, and springs every 6 months
1992	Phase I Remedial Investigation	Golder/Monsanto	Remedial Investigation report for Monsanto Plant site
1993	Phase II Remedial Investigation Fate and Transport Model	Golder/Monsanto	Groundwater model to characterize fate and transport of constituents in groundwater
1995	Solute Transport Model	Golder/Monsanto	Solute transport model to predict the fate and transport of constituents in groundwater
1995	Phase II Remedial Investigation	Golder/Monsanto	Phase II Remedial Investigation
1998 to date	Annual groundwater sampling	Golder/Monsanto	Monsanto samples between 50 and 60 monitoring wells, offsite wells, and springs annually
2003	Solute Transport Model	Golder/Monsanto	Updated solute transport model to predict the fate and transport of constituents in groundwater, using additional data and a graphical, probabilistic modeling tool
2003	Five Year Review	Golder/Monsanto	Review of monitoring data and groundwater model predictions to evaluate progress of selected remedial remedy, per the Record of Decision
2007	Groundwater Investigation - South of Plant	Golder/Monsanto	Installed 4 new groundwater monitoring wells (2007 Monitoring Wells)
Ongoing	Annual groundwater sampling	Golder/Monsanto	Monsanto samples between 50 and 60 monitoring wells, offsite wells, and springs annually

TABLE 4

Sample Collection Summary
June/July 2007

Location	Sample ID	Formation Monitored	Sample Date	Sample Time	Method	Purge Water Disposal Method	Filter/ Unfilter	Filter Size	Notes
Surface Water/Effluent									
Effluent 1	70049	NA	6/23/07	15:00	Grab	NA	U		
Effluent 2	70050	NA	6/23/07	15:00	Grab	NA	U		
Effluent 3	70051	NA	6/23/07	15:00	Grab	NA	U		
Soda Down	70063	NA	6/25/07	14:45	Grab	NA	U		
Soda Down Weir	70052	NA	6/23/07	15:15	Grab	NA	U		
Soda Up	70048	NA	6/23/07	14:45	Grab	NA	U		
Pond Inlet	70047	NA	6/23/2007	14:20	Grab	NA	U		
Groundwater									
Big Spring	70061	NA	6/25/2007	13:45	Grab	NA	U		
Calf Spring	70016	NA	6/20/2007	17:30	Grab	NA	U		
City Park Spring	70054	NA	6/23/2007	16:15	Grab	NA	U		
Harris Well	70014	UBZ	6/20/2007	16:25	Non-Dedicated Pump	GROUND	U		
Homestead Spring	70062	NA	6/25/2007	14:15	Grab	NA	U		
Lewis Well	70064	NA	6/25/2007	15:10	Operating Well	GROUND	U		
Mormon A Spring	70017	NA	6/20/2007	17:45	Grab	NA	U		
Mormon Creek	70053	NA	6/23/2007	15:45	Grab	NA	U		
PW-01	70058	UBZ,LBZ	6/24/2007	12:50	Operating Well	GROUND	U		
PW-02	70059	UBZ,LBZ	6/24/2007	15:00	Operating Well	GROUND	U		
PW-03	70071	UBZ,LBZ	7/10/2007	19:30	Operating Well	GROUND	U		
PW-04	70005	UBZ,LBZ	6/19/2007	15:35	Operating Well	GROUND	U		
SO2 Landfill North	70008	UBZ	6/19/2007	17:20	Dedicated Pump	GROUND	F		
SO2 Landfill South	70007	UBZ	6/19/2007	17:00	Dedicated Pump	GROUND	U		
SW Spring	70018	NA	6/20/2007	18:00	Grab	NA	U		
TW-08	70012	UBZ	6/20/2007	13:00	Non-Dedicated Pump	TANK	U		
TW-10	70011	UBZ	6/20/2007	12:20	Dedicated Pump	TANK	U		
TW-11	70026	LBZ	6/21/2007	14:00	Dedicated Pump	TANK	U		
TW-11	70027	LBZ	6/21/2007	14:05	Dedicated Pump	TANK	U		Duplicate
TW-12	70028	UBZ	6/21/2007	14:40	Dedicated Pump	TANK	U		
TW-12	70029	UBZ	6/21/2007	14:45	Dedicated Pump	TANK	U		Split
TW-15	70009	UBZ	6/19/2007	18:00	Dedicated Pump	GROUND	U		
TW-16	70023	UBZ	6/21/2007	11:05	Dedicated Pump	TANK	U		
TW-17	70024	UBZ	6/21/2007	11:50	Dedicated Pump	TANK	U		
TW-18	70025	LBZ	6/21/2007	12:30	Dedicated Pump	GROUND	U		
TW-20	70019	UBZ	6/21/2007	8:40	Dedicated Pump	TANK	U		
TW-20	70020	UBZ	6/21/2007	8:45	Dedicated Pump	TANK	U		Duplicate
TW-22	70022	UBZ	6/21/2007	10:00	Dedicated Pump	TANK	U		
TW-24	70013	UBZ	6/20/2007	14:00	Non-Dedicated Pump	GROUND	U		
TW-26	70046	UBZ	6/23/2007	12:10	Dedicated Pump	TANK	U		
TW-29	70004	UBZ	6/19/2007	15:15	Dedicated Pump	GROUND	U		
TW-30	70045	UBZ	6/23/2007	10:25	Dedicated Pump	TANK	U		
TW-33	70030	UBZ	6/21/2007	17:20	Dedicated Pump	TANK	U		
TW-33	70031	UBZ	6/21/2007	17:25	Dedicated Pump	TANK	U		Duplicate
TW-33	70032	UBZ	6/21/2007	17:30	Dedicated Pump	TANK	U		Split
TW-34	70001	UBZ	6/19/2007	13:00	Dedicated Pump	GROUND	U		
TW-35	70002	UBZ	6/19/2007	14:00	Dedicated Pump	GROUND	U		
TW-35	70003	UBZ	6/19/2007	14:05	Dedicated Pump	GROUND	U		Split
TW-37	70034	UBZ	6/22/2007	8:40	Dedicated Pump	TANK	U		
TW-38	70010	UBZ	6/20/2007	9:15	Non-Dedicated Pump	TANK	U		
TW-39	70021	UBZ	6/21/2007	9:35	Dedicated Pump	TANK	U		
TW-40	70055	UBZ	6/24/2007	9:00	Hand Bailed	TANK	F	0.45 µm	
TW-41	70044	UBZ	6/23/2007	10:00	Dedicated Pump	TANK	U		
TW-43	70056	UBZ	6/24/2007	10:15	Hand Bailed	TANK	F	0.45 µm	
TW-44	70060	LBZ	6/25/2007	9:20	Dedicated Pump	TANK	U		
TW-45	70035	LBZ	6/22/2007	9:45	Dedicated Pump	TANK	U		
TW-48	70006	UBZ	6/19/2007	16:30	Dedicated Pump	GROUND	U		
TW-49	70033	UBZ	6/21/2007	18:10	Dedicated Pump	GROUND	U		
TW-50	70043	UBZ	6/23/2007	9:20	Dedicated Pump	TANK	U		
TW-53	70037	UBZ	6/22/2007	14:40	Dedicated Pump	TANK	U		
TW-54	70038	UBZ	6/22/2007	15:20	Dedicated Pump	TANK	U		
TW-54	70039	UBZ	6/22/2007	15:25	Dedicated Pump	TANK	U		Duplicate
TW-55	70040	UBZ	6/22/2007	16:12	Dedicated Pump	TANK	U		
TW-55	70041	UBZ	6/22/2007	16:15	Dedicated Pump	TANK	U		Split
TW-56	70042	UBZ	6/22/2007	18:00	Dedicated Pump	TANK	U		
TW-57	70036	UBZ	6/22/2007	11:30	Dedicated Pump	GROUND	U		
TW-59	70070	UBZ	7/10/2007	19:00	Dedicated Pump	GROUND	U		
TW-60	70069	UBZ	7/10/2007	17:45	Dedicated Pump	GROUND	U		
TW-61	70067	UBZ	7/10/2007	16:30	Dedicated Pump	GROUND	U		
TW-61	70068	UBZ	7/10/2007	16:35	Dedicated Pump	GROUND	U		
TW-62	70065	UBZ	7/10/2007	15:05	Dedicated Pump	GROUND	U		
TW-62	70066	UBZ	7/10/2007	15:10	Dedicated Pump	GROUND	U		
QA/QC									
DI Blank	70057	NA	6/24/2007	12:00	Grab	NA	U		Blank
Grundfos Blank	70015	NA	6/20/2007	16:30	Grab	NA	U		Equip. Blank

NOTES:

UBZ	Upper Basalt Zone
LBZ	Lower Basalt Zone
U	Unfiltered
F	Filtered
NA	Not applicable

TABLE 5

Analytical Methods for Monsanto Groundwater Sampling

Parameters	Analyzed in 2006	Analytical Method	Reporting Limit (mg/L)
Total Metals			
Cadmium	Y	6010B	0.002
Calcium	Y	6010B	0.04
Magnesium	Y	6010B	0.06
Manganese	Y	6010B	0.004
Molybdenum	Y	6010B	0.008
Selenium	Y	6010B / 7740	0.04 / 0.003
Vanadium[a]	Y	6010B	0.005
Zinc	Y	6010B	0.01
Other Ions			
Alkalinity (CaCO3)	Y	2320B	1
CO3/CaCO3	Y	2320B	1
HCO3/CaCO3	Y	2320B	1
Ammonia as N[a]	Y	350.1	0.03
Chloride	Y	300	1
Fluoride	Y	300	0.1
Hardness	Y	2340B	0.35
Nitrate and Nitrite As N	Y	353.2	0.02
Total Phosphorus	Y	365.2	0.01
Specific Conductance	Y	120.1	0.01
Sulfate	Y	300	0.3
TDS	Y	160.1	10
Field Parameters			
Conductivity	Y	NA	NA
Dissolved Oxygen	Y	NA	NA
Eh	N	NA	NA
pH	Y	NA	NA
Turbidity	Y	NA	NA
Temperature	Y	NA	NA

NOTES:

Y = Yes

N = No

NA = Not applicable

a. Analyzed only in wells completed on east side of plant (TW-11, TW-12, TW-33, TW-38, and TW-56) , Lewis Well, and in plant production wells PW-01, PW-02, and PW-03)

TABLE 6

Sampling Information and Groundwater Elevations
June/July 2007

LOCATION	DATE	DEPTH TO WATER (ft)	WELL VOLUME (gal)	PURGE VOLUME (gal)	MEASUREMENT POINT (MP)	MP ELEVATION (ft)	2007 GROUNDWATER ELEVATION (ft)	COMMENTS
Cali Spring		na	na	na	Water Surface	5,858.47	5,858.47	Water Surface Elevation
Dog Spring		na	na	na	Water Surface	5,847.58	5,847.58	Water Surface Elevation
Homestead Spring		na	na	na	Water Surface	5,815.86	5,815.86	Water Surface Elevation
Hooper Spring		na	na	na	Water Surface	5,853.78	5,853.78	Water Surface Elevation
Mormon A Spring		na	na	na	Water Surface	5,850.60	5,850.60	Water Surface Elevation
Mormon B Spring		na	na	na	Water Surface	5,843.55	5,843.55	Water Surface Elevation
Mormon C Spring		na	na	na	Water Surface	5,834.01	5,834.01	Water Surface Elevation
SW Spring		na	na	na	Water Surface	5,859.25	5,859.25	Water Surface Elevation
HARRIS	7/11/07	16.12	73.14	219.4	Top of steel 1" pipe	5,877.56	5,861.44	
TW-07	7/9/07	Blocked	No sample		Top of PVC well cap	5,845.11	-	
TW-08	7/9/07	15.29	58.21	175.60	Top of PVC well cap	5,884.88	5,869.59	
TW-09	7/9/07	7.72	No sample		Top of coupling	5,884.91	5,877.19	
TW-10	7/9/07	16.41	9.48	28.4	Top of seal	5,885.53	5,869.12	
TW-11	7/11/07	71.64	48.35	145.2	Top of coupling	5,538.03	5,866.39	
TW-12	7/11/07	73.22	28.21	84.6	Top of seal	5,539.23	5,866.01	
TW-13	7/9/07	18.92	No sample		Top of seal	5,958.35	5,939.43	
TW-14	7/9/07	17.03	No sample		Top of PVC casing	5,988.59	5,971.55	
TW-15	7/9/07	19.82	35.09	105.3	Top of seal	5,988.27	5,968.45	
TW-16	7/9/07	Blocked	14.77	44.3	Top of seal	5,998.39	-	
TW-17	7/9/07	54.64	45.72	137.2	Top of seal	5,998.32	5,943.65	
TW-18	7/9/07	62.09	127.95	383.9	Top of seal	5,996.89	5,934.85	
TW-19	7/9/07	30.11	No sample		Top of PVC casing	5,893.07	5,862.96	
TW-20	7/9/07	30.33	14.64	43.9	Top of seal	5,893.37	5,863.04	
TW-21	7/9/07	25.25	No sample		Top of coupling	5,893.68	5,868.43	
TW-22	7/9/07	72.06	36.29	108.9	Top of seal	5,954.70	5,882.64	
TW-23	7/9/07	71.35	No sample		Top of seal	5,954.70	5,883.35	
TW-24	7/9/07	71.74	25.90	77.7	Top of PVC casing	5,954.43	5,882.69	
TW-25	7/9/07	Blocked	44.46	133.4	Top of seal	5,991.42	-	
TW-28	7/9/07	41.36	No sample		Top of coupling	5,989.40	5,948.04	
TW-29	7/9/07	41.64	12.88	38.0	Top of coupling	5,989.59	5,947.95	
TW-30	7/9/07	62.73	10.06	30.2	Top of coupling	5,992.73	5,930.00	
TW-31	7/11/07	26.97	No sample		Top of PVC casing	5,975.29	5,948.32	
TW-32	7/11/07	29.29	No sample		Top of coupling	5,975.91	5,946.42	
TW-33	7/11/07	28.40	36.55	109.6	Top of seal	5,975.86	5,947.46	
TW-34	7/9/07	30.46	33.42	99.4	Top of coupling	5,893.43	5,862.97	
TW-35	7/9/07	33.42	41.17	123.5	Top of seal	5,897.16	5,864.04	
TW-37	7/11/07	61.56	26.27	78.8	Top of seal	5,959.17	5,891.21	
TW-38	7/9/07	92.81	11.30	33.9	Top of PVC casing	5,972.91	5,880.10	
TW-39	7/9/07	33.09	19.42	58.3	Top of seal	5,897.07	5,862.98	
TW-42	7/9/07	36.62	4.59	13.8	Top of seal	5,989.94	5,953.32	
TW-41	7/9/07	61.68	11.72	35.2	Top of coupling	5,994.31	5,932.63	
TW-42	7/9/07	85.45	No sample		Top of seal	5,999.07	5,954.62	
TW-43	7/9/07	85.58	5.55	17.9	Top of PVC	5,989.08	5,923.50	
TW-44	7/9/07	Blocked	45.43	136.3	Top of seal = 0.04' above TOC	5,989.41	-	
TW-45	7/11/07	71.23	112.18	336.5	Top of coupling = 0.26' above TOC	5,959.17	5,887.94	
TW-48	7/9/07	62.32	11.05	33.2	Top of coupling	5,989.40	5,927.08	
TW-49	7/9/07	73.6	12.45	37.4	Top of seal	5,996.94	5,923.33	
TW-50	7/9/07	59.57	30.43	91.3	Top of seal	5,992.94	5,933.37	
TW-53	7/9/07	22.57	15.55	46.7	Top of coupling	5,880.65	5,850.08	
TW-54	7/11/07	23.45	24.11	72.3	Top of coupling	5,883.95	5,859.51	
TW-55	7/11/07	33.73	33.98	101.9	Top of coupling	5,866.33	5,856.61	
TW-56	7/11/07	37.13	34.75	104.3	Top of coupling	5,910.22	5,853.05	
TW-57	7/11/07	17.59	25.37	75.9	Top of coupling	5,952.74	5,942.15	
TW-58	7/9/07	59.77	No sample		Top of Steel Casing	5,892.74	5,852.97	
TW-59	7/9/07	17.59			Top of coupling	5,858.64	5,839.05	
TW-60	7/9/07	31.74			Top of coupling	5,869.42	5,837.68	
TW-61	7/9/07	32.61			Top of coupling	5,878.75	5,846.14	
TW-62	7/9/07	35.94			Top of coupling	5,851.31	5,849.37	
SOL Landfill North	7/9/07	63.82	25.48	76.40	Top of coupling	TBD	-	Not surveyed
SOL Landfill South	7/9/07	85.15	25.13	75.50	Top of coupling	TBD	-	Not surveyed

TBD - to be determined

TABLE 7

Analytical Results for 2007 Sample Round

Location	SampleID	Filtered	Sample type	Alkalinity (Total) (mg/L as CaCO3)	Q	Alkalinity (Carbonate) (mg/L as CaCO3)	Q	Alkalinity (Bicarbonate) mg/L as CaCO3	Q	Ammonia as N (mg/L)	Q	Cadmium mg/L	Q
REMEDIATION GOAL												0.005	
Groundwater													
Big Spring	70061	N	Grab	435		<1	U	435		1.55		<0.0006	U
Calf Spring	70016	N	Grab	453		<1	U	453		0.04		0.0095	
City Park Spring	70054	N	Grab	598		<1	U	598		0.97		<0.0006	U
Harris	70014	N	Grab	442		<1	U	442		<0.03	U	0.00032	B
Homestead Spring	70062	N	Grab	601		<1	U	601		<0.03	U	<0.0006	U
Lewis	70064	N	Grab	493	J	<1	UJ	493	J	0.09		<0.0006	U
Mormon A Spring	70017	N	Grab	472		<1	U	472		<0.03	U	0.0174	
Mormon Creek	70053	N	Grab	567		<1	U	567		0.1		0.0036	
PW-01	70058	N	Grab	474		<1	U	474		<0.03	U	0.0314	
PW-02	70059	N	Grab	432		<1	U	432		<0.03	U	0.0016	B
PW-03	70071	N	Grab	455		<1	U	455		<0.03	U	0.0014	B
PW-04	70005	N	Grab	623	J	<1	UJ	623	J	<0.03	U	<0.0003	U
SO2 Landfill North	70008	N	Grab	222	J	<1	UJ	222	J	<0.03	U	<0.0003	U
SO2 Landfill South	70007	N	Grab	475	J	<1	UJ	475	J	<0.03	U	<0.0003	U
SW Spring	70018	N	Grab	885		<1	U	885		0.06		0.0025	
TW-08	70012	N	Grab	1,460		<1	U	1,460		0.57		<0.0002	U
TW-10	70011	N	Grab	793		<1	U	793		<0.03	U	0.00031	B
TW-11	70026	N	Grab	382	J	26.6	J	409	J	3.47		<0.0006	U
TW-11	70027	N	Duplicate	376	J	22.5	J	398	J	3.28		<0.0006	U
TW-12	70028	N	Grab	364	J	34.2	J	398	J	9.8		<0.0006	U
TW-12	70029	N	Split	410		<1	U	410		9.35		<0.0002	U
TW-15	70009	N	Grab	397	J	<1	UJ	397	J	<0.03	U	<0.0003	U
TW-16	70023	N	Grab	629	J	9.3	J	638	J	<0.03	U	0.513	
TW-17	70024	N	Grab	1,140	J	60.6	J	1,200	J	0.23		0.0015	B
TW-18	70025	N	Grab	1,180	J	6.9	J	1,190	J	0.35		<0.0006	U
TW-20	70019	N	Grab	370	J	<1	UJ	370	J	<0.03	U	0.0068	
TW-20	70020	N	Duplicate	379	J	<1	UJ	379	J	<0.03	U	0.0052	

TABLE 7

Analytical Results for 2007 Sample Round

Location	SampleID	Filtered	Sample type	Alkalinity (Total) (mg/L as CaCO3)	Q	Alkalinity (Carbonate) (mg/L as CaCO3)	Q	Alkalinity (Bicarbonate) mg/L as CaCO3	Q	Ammonia as N (mg/L)	Q	Cadmium mg/L	Q
REMEDIATION GOAL												0.005	
Groundwater													
TW-22	70022	N	Grab	758	J	17.9	J	776	J	1.48	U	0.0234	
TW-24	70013	N	Grab	466		<1	U	466		0.56		0.244	
TW-26	70046	N	Grab	501		<1	U	501		0.92		<0.0006	U
TW-29	70004	N	Grab	447		<1	U	447		<0.03	U	<0.0003	U
TW-30	70045	N	Grab	412		<1	U	412		<0.03	U	<0.0006	U
TW-33	70030	N	Grab	385	J	39.4	J	424	J	<0.02	U	<0.0006	U
TW-33	70031	N	Duplicate	426	J	<1	U	426	J	<0.02	U	<0.0006	U
TW-33	70032	N	Split	415		<1	U	415		<0.01	U	0.0007	
TW-34	70001	N	Grab	619	J	<1	UJ	619	J	0.03		<0.0003	U
TW-35	70002	N	Grab	1,290	J	<1	UJ	1,290	J	0.2		<0.0003	U
TW-35	70003	N	Split	1,240		<1	U	1,240		0.14		<0.0002	U
TW-37	70034	N	Grab	348	J	30.3	J	378	J	0.55		0.577	
TW-38	70010	N	Grab	406		<1	U	406		<0.03	U	0.00032	B
TW-39	70021	N	Grab	488	J	<1	UJ	488	J	<0.03	U	0.0093	
TW-40	70055	Y	Grab	404		<1	U	404		<0.03	U	2.41	
TW-41	70044	N	Grab	449		<1	U	449		<0.03	U	<0.0006	U
TW-43	70056	Y	Grab	441		<1	U	441		<0.03	U	1.74	
TW-44	70060	N	Grab	904		<1	U	904		0.32		<0.0006	U
TW-45	70035	N	Grab	943	J	57.5	J	1,000	J	0.66		0.002	B
TW-48	70006	N	Grab	399	J	<1	UJ	399	J	<0.03	U	<0.0003	U
TW-49	70033	N	Grab	448	J	43	J	491	J	<0.03	U	<0.0006	U
TW-50	70043	N	Grab	521		<1	U	521		0.03		0.0077	
TW-53	70037	N	Grab	474	J	<1	UJ	474	J	<0.03	U	<0.0006	U
TW-54	70038	N	Grab	373	J	<1	UJ	373	J	<0.03	U	<0.0006	U
TW-54	70039	N	Duplicate	377	J	<1	UJ	377	J	<0.03	U	<0.0006	U
TW-55	70040	N	Grab	883	J	<1	UJ	883	J	<0.03	U	<0.0006	U
TW-55	70041	N	Split	885		<1	U	885		<0.01	U	<0.0002	U
TW-56	70042	N	Grab	411	J	<1	UJ	411	J	<0.03	U	<0.0006	U
TW-57	70036	N	Grab	728	J	<1	UJ	728	J	<0.03	U	<0.0006	U
TW-59	70070	N	Grab	797		<1	U	797		<0.03	U	<0.0006	U
TW-60	70069	N	Grab	1,280		<1	U	1,280		0.39		<0.0006	U
TW-61	70067	N	Grab	1,180		<1	U	1,180		0.5		<0.0006	U
TW-61	70068	N	Split	1,120		<1	U	1,120		0.517		<0.0004	U
TW-62	70065	N	Grab	786		<1	U	786		0.07		<0.0006	U
TW-62	70066	N	Duplicate	789		<1	U	789		0.08		<0.0006	U

TABLE 7

Analytical Results for 2007 Sample Round

Location	SampleID	Filtered	Sample type	Alkalinity (Total) (mg/L as CaCO3)	Q	Alkalinity (Carbonate) (mg/L as CaCO3)	Q	Alkalinity (Bicarbonate) mg/L as CaCO3	Q	Ammonia as N (mg/L)	Q	Cadmium mg/L	Q
REMEDIATION GOAL												0.005	
Surface Water/Effluent													
Effluent 1	70049	N	Grab	483		4.2		487		0.05		0.0121	
Effluent 2	70050	N	Grab	483		5.2		489		0.04		0.0118	
Effluent 3	70051	N	Grab	486		10.8		486		0.04		0.0116	
Soda Down	70063	N	Grab	838	J	<1	UJ	838	J	0.06		<0.0006	U
Soda Down Weir	70052	N	Grab	534		<1	U	534		0.12		<0.0006	U
Soda Up	70048	N	Grab	531		<1	U	531		0.09		<0.0006	U
Pond Inlet	70047	N	Grab	477		<1	U	477		0.06		0.0225	

Notes:
"-" Not applicable
na: not analyzed

J - The result is an estimated value.

UJ - The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
U - The analyte was not detected at the method detection limit.

TABLE 7

Analytical Results for 2007 Sample Round

Location	Calcium mg/L	Q	Chloride mg/L	Q	Fluoride (mg/L)	Q	Magnesium (mg/L)	Q	Manganese (mg/L)	Q	Molybdenum (mg/L)	Q	Nitrate and Nitrite as N (mg/L)	Q
REMEDIATION GOAL					4				0.18				10	
Groundwater														
Big Spring	107		34.6		0.38		47.3		<0.0007	U	0.22		5.18	
Calf Spring	185		128		3.09		137		0.0147		0.0691		5.8	
City Park Spring	141		39.3		0.81		67.9		0.0847		0.224		5.62	
Harris	188		121		2.54		135		0.0026	B	0.0652		8.96	
Homestead Spring	108		27.6		0.61		99.1		<0.0007	U	0.0155		14.3	
Lewis	132		54.7	J	0.2	J	80.4		<0.0007	U	0.098		8.48	
Mormon A Spring	167		120		2.94		137		<0.0009	U	0.0757		9.22	
Mormon Creek	154		171		2.86		134		0.0195		0.0623		4.54	
PW-01	136		99.3		0.89		69.2		<0.0007	U	0.0386		4.56	
PW-02	133		54.4		0.46		59.7		<0.0007	U	0.0501		3.74	
PW-03	125		62		0.21		58.1		<0.0007	U	0.0449		3.64	
PW-04	152		32.4	J	0.41	J	88.9		<0.0008	U	0.008	U	4.23	
SO2 Landfill North	93.1		24.9	J	0.47	J	17.9		0.0019	J	0.008	U	16.6	
SO2 Landfill South	116		13.9	J	0.33	J	60.3		<0.0008	U	0.008	U	3.92	
SW Spring	119		13.8		0.27		136		0.019		0.0169		1.52	
TW-08	56.4		22.2		<0.1		308		0.109		0.0036	B	<0.02	U
TW-10	145		55.5		0.32		152		<0.0009	U	0.0282		5.76	
TW-11	100		39.4	J	0.35	J	38.9		<0.0007	U	0.0131		4.43	
TW-11	98		39.3	J	0.36	J	38.1		<0.0007	U	0.0135		4.36	
TW-12	102		35.6	J	0.45	J	39		0.0446		0.512		5.57	
TW-13	92.7		35.9		<1	U	35		0.042		0.495		5.36	
TW-15	108		11.9	J	0.27	J	42.6		<0.0008	U	0.008	U	1.74	
TW-16	158		78.1	J	2.16	J	103		<0.0007	U	0.0216		5.38	
TW-17	58.3		125	J	2.39	J	274		2.55		0.044		<0.02	U
TW-18	107		15.3	J	0.19	J	205		0.4		0.015		<0.02	U
TW-20	191		99.3	J	2.05	J	119		<0.0009	U	0.0537		10.5	
TW-20	185	J-	101	J	2.09	J	115		<0.0007	U	0.0622		11.4	

TABLE 7

Analytical Results for 2007 Sample Round

Location	Calcium mg/L	Q	Chloride mg/L	Q	Fluoride (mg/L)	Q	Magnesium (mg/L)	Q	Manganese (mg/L)	Q	Molybdenum (mg/L)	Q	Nitrate and Nitrite as N (mg/L)	Q
REMEDIATION GOAL					4				0.18				10	
Groundwater														
TW-22	140		32.2	J	4.17	J	105		0.786		0.328		4.63	
TW-24	115		48.3		5.95		81.1		0.199		0.431		6.06	
TW-26	147		330		1.84		129		0.564		0.135		6.48	
TW-29	113		14.1		0.32		57		<0.0008	U	0.008	U	4.13	
TW-30	126		86.2		4.45		63.6		<0.0007	U	0.156		8.31	
TW-33	107		18.9	J	0.35	J	38.2		<0.0007	U	0.0505		2.78	
TW-33	106		18.9	J	0.34	J	37.8		<0.0007	U	0.0491		2.69	
TW-33	115		17.3		<0.5	U	39.7		<0.001	U	0.048		2.45	
TW-34	137		39.3	J	0.6	J	107		0.222		0.0081	J+	0.034	
TW-35	64		36.8	J	<0.1	UJ	291		0.158		0.0091	J+	0.021	
TW-35	58.1		31.6		<1	U	248		0.151		0.01		<0.01	U
TW-37	186		130	J	9.77	J	93.4		0.589		0.299		10.8	
TW-38	119		46.9		0.2		49.1		<0.0009	U	0.0503		3.48	
TW-39	150		115	J	3.34	J	137		<0.0007	U	0.0662		9.56	
TW-40	279		369		4.65		127		0.0365		0.167		16.2	
TW-41	183		243		2.81		107		0.0099		0.119		10.3	
TW-43	248		278		5.16		110		0.0091		0.154		13.2	
TW-44	58.2		26.7		0.85		193		0.22		0.0201		<0.02	U
TW-45	130		30.1	J	0.93	J	158		0.432		0.0292		0.03	
TW-48	103		14.4	J	0.3	J	49.9		0.0025	J	0.008	U	5.1	
TW-49	118		17.3	J	0.43	J	61.8		<0.0007	U	0.0158		3.92	
TW-50	112		190		1.01		156		0.489		0.0461		0.805	
TW-53	192		111	J	2.92	J	126		<0.0007	UJ	0.0581		7.15	
TW-54	167		98.9	J	3.66	J	112		<0.0007	UJ	0.0896		9.7	
TW-54	158		98.6	J	3.68	J	105		<0.0007	UJ	0.0868		9.69	
TW-55	242		59.4	J	0.26	J	138		<0.0007	UJ	0.0121		4.15	
TW-55	211		59.7		<1	U	126		<0.001	U	0.01		3.88	
TW-56	115		52.9	J	0.39	J	64.3		0.0208		0.0914		5.77	
TW-57	145		14.5	J	0.57	J	83.6		<0.0007	U	0.0135		1.47	
TW-59	203		60.3		<0.1	U	123		<0.0007	U	0.0141		5.76	
TW-60	68.2		14.9		<0.1	U	235		6.04		0.0163		<0.02	U
TW-61	95.6		22.8		<0.1	U	211		0.493		0.0119		0.042	
TW-61	94.6		22.1		<0.5	U	206		0.487		0.015		0.037	
TW-62	209		74.4		0.22		133		0.0039	B	0.0175		5.00	
TW-62	208		76.1		0.22		133		0.0035	B	0.018		5.13	

TABLE 7

Analytical Results for 2007 Sample Round

Location	Calcium mg/L	Q	Chloride mg/L	Q	Fluoride (mg/L)	Q	Magnesium (mg/L)	Q	Manganese (mg/L)	Q	Molybdenum (mg/L)	Q	Nitrate and Nitrite as N (mg/L)	Q
REMEDIATION GOAL					4				0.18				10	
Surface Water/Effluent														
Effluent 1	126		209		0.8		63.2		<0.0007	U	0.037		4.14	
Effluent 2	127		209		0.8		65.3		<0.0007	U	0.0382		4.12	
Effluent 3	129		210		0.8		65.5		<0.0007	U	0.0412		3.89	
Soda Down	124		43.3	J	0.71	J	127		0.114		0.0294		0.993	
Soda Down Weir	79.5		14.2		0.47		72.7		0.119		0.0138		0.233	
Soda Up	77.7		10.1		0.51		72.8		0.125		0.0126		0.304	
Pond Inlet	168		2004		<0.5	U	74.6		<0.0007	U	0.0375		5.32	

Notes:
"-" Not applicable
na: not analyzed

J - The result is an estimated value.

UJ - The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
U - The analyte was not detected at the method detection limit.

TABLE 7

Analytical Results for 2007 Sample Round

Location	Phosphorus (Total) (mg/L)	Q	Potassium (mg/L)	Q	Selenium (mg/L)	Q	Sodium (mg/L)	Sulfate (mg/L)	Q	Total Dissolved Solids (mg/L)	Q	Vanadium (mg/L)	Q	Zinc (mg/L)	Q
REMEDIATION GOAL					0.05										
Groundwater															
Big Spring	0.04		5.28		0.0017	B	40.5	82.7		579		0.0031	B	<0.003	U
Calf Spring	0.4		26.3		0.137		106	553		1,560		0.0084	J+	0.172	
City Park Spring	0.09		8.15		0.0021	B	46.5	103		784		0.0035	B	<0.003	U
Harris	0.17		24		0.123		98.7	523		1,490		0.005	U	<0.0021	U
Homestead Spring	0.04		6.24		0.0073		32	87.2	J	776	J	0.0052		<0.003	U
Lewis	0.14		7.28		0.0085		40.1	198		894		0.0044	B	<0.003	U
Mormon A Spring	0.33		24.2		0.136		98.8	509		1,490		0.0151	J+	0.231	
Mormon Creek	0.56		21.3		0.106		137	400		1,470		0.0136		0.0823	
PW-01	0.87		9.52		0.0167		56.1	136		851		0.0125		0.0415	
PW-02	0.5		5.62		0.0064		32.4	102		672		0.0372		0.0056	B
PW-03	0.47		5.42		0.0043		34.1	103		702		0.0809		0.0033	B
PW-04	0.11		6.61		0.003	U	28.6	82.2	J	774	J	0.0027	J	<0.0007	U
SO2 Landfill North	0.06		2.24		0.003	U	24	43.2	J	432	J	0.0074		<0.0007	U
SO2 Landfill South	0.07		4.94		0.003	U	19.2	70	J	580	J	0.0022	J	<0.0007	U
SW Spring	0.18		10.7		0.0112	J+	40	59.9		972		0.005	U	0.0409	
TW-08	0.91		21.6		0.003	U	48.2	77.4		1,330		0.005	U	<0.0021	U
TW-10	0.59		10.4		0.132		61.6	190		1,110		0.0072	J+	0.0078	B
TW-11	0.05		7.57		0.0006	B	74.9	109	J	633	J	0.0023	B	<0.003	U
TW-11	0.05		7.47		0.00062	B	72.5	109	J	628	J	0.0027	B	<0.003	U
TW-12	0.64		7.56		0.00097	B	54.1	102	J	572	J	0.741		0.0035	B
TW-12	0.446		7.17		0.003		52.1	103		626		0.722		<0.01	U
TW-15	0.03		2.5		0.003	U	8.05	36.6	J	451	J	0.0018	J	0.01	U
TW-16	1.68		9.88		0.0566		57.8	161	J	1,010	J	0.061		1.96	
TW-17	1.32		19.8		0.0024	B	77.7	155	J	1,430	J	0.0025	B	0.0316	
TW-18	0.47		18.9		0.0002	B	45.2	60.7	J	1,140	J	0.0012	B	<0.003	U
TW-20	0.22		19.7		0.0847		85	552	J	1,450	J	0.0058	J+	0.0848	
TW-20	0.21		18.9		0.0798		80.5	558	J	1,440	J	0.0066		0.0873	

TABLE 7

Analytical Results for 2007 Sample Round

Location	Phosphorus (Total) (mg/L)	Q	Potassium (mg/L)	Q	Selenium (mg/L)	Q	Sodium (mg/L)		Sulfate (mg/L)	Q	Total Dissolved Solids (mg/L)	Q	Vanadium (mg/L)	Q	Zinc (mg/L)	Q
REMEDIATION GOAL					0.05											
Groundwater																
TW-22	0.46		35.3		0.105		54.9		148	J	1,920	J	0.0057		0.118	
TW-24	0.25		22.3		0.17		50.1		189		879		0.0897		1.71	
TW-26	0.48		27.6		0.15		157		325		1,540		0.0053		<0.003	U
TW-29	0.07		4.76		0.003	U	18.6		68.8		577		0.0023	J	<0.0007	U
TW-30	5.4		26.8		0.0916		73.8		201		929		0.0134		<0.003	U
TW-33	0.19		2.35		0.0012	B	16.1		39.5	J	498	J	0.514		0.0157	
TW-33	0.2		2.33		0.0012	B	16		39.4	J	502	J	0.506		0.015	
TW-33	0.648		2.56		0.003		18.1		41.2		515		0.556		0.01	
TW-34	0.09		11.3		0.003	U	26.2		161	J	858	J	<0.0005	U	<0.0007	U
TW-35	0.49		18.8		0.003	U	44.5		111	J	1,270	J	<0.0005	U	<0.0007	U
TW-35	0.14		17.1		0.002	U	40.8		112		1,330		<0.003	U	<0.01	U
TW-37	0.85		39.2		0.162		63.6		407	J	1,290	J	0.0517		3.61	
TW-38	0.15		3.51		0.0033	J+	25.2		75.9		594		0.155		<0.0021	U
TW-39	0.33		25.8		0.125		99.4		527	J	1,500	J	0.0128		0.166	
TW-40	6.7		49.4		0.282		205		696		2,180		0.0461		4.44	
TW-41	4.8		30.4		0.13		143		441		1,610		0.0059		0.0212	
TW-43	10.4		47.2		0.343		176		504		1,970		0.0695		2.34	
TW-44	2.4		12.2		0.0007	B	31.6		90		965		0.0014	B	0.0499	
TW-45	0.4		15.8		0.0003	B	44.3		120	J	1,120	J	0.0017	B	0.0345	
TW-48	0.09		4.41		0.003	U	17.3		63.8	J	518	J	0.0028	U	0.008	U
TW-49	0.11		4.89		0.0015	B	19.4		74.5	J	610	J	0.0031	B	<0.003	U
TW-50	0.42		13.1		0.0191		70.3		337		1,230		0.0024	B	0.0169	
TW-53	0.16		19.2		0.115		81.4		472	J	1,430	J	0.0049	B	<0.003	U
TW-54	0.2		22.5		0.0849		84.4		492	J	1,390	J	0.0056		0.092	
TW-54	0.2		21.3		0.085		77.5		490	J	1,350	J	0.0053		0.0961	
TW-55	0.14		10.4		0.0413		41.6		252	J	1,290	J	0.003	B	<0.003	U
TW-55	0.204		10.2		0.12		42		259		1,320		<0.003	U	<0.01	U
TW-56	0.98		7.31		0.00067	B	29.1		128	J	687	J	0.0027	B	0.0268	
TW-57	0.15		6.2		0.0012	B	22.9		72.5	J	792	J	0.0026	B	<0.003	U
TW-59	0.11		9.65		0.0321		48.3		255		1,230		0.0026	B	<0.003	U
TW-60	0.1		14		0.00037	B	35.4		69.5		1,180		<0.001	U	0.0083	B
TW-61	0.97		16		0.00057	B	37.5		98.3		1,180		<0.001	U	<0.003	U
TW-61	0.815		15.7		<0.002	U	37.3		97.5		1,200		<0.003	U	0.01	U
TW-62	0.12		11.9		0.0456		60.7		319		1,360		0.0027	B	<0.003	U
TW-62	0.13		11.9		0.0454		60.4		325		1,350		0.0029	B	<0.003	U

TABLE 7

Analytical Results for 2007 Sample Round

Location	Phosphorus (Total) (mg/L)	Q	Potassium (mg/L)	Q	Selenium (mg/L)	Q	Sodium (mg/L)		Sulfate (mg/L)	Q	Total Dissolved Solids (mg/L)	Q	Vanadium (mg/L)	Q	Zinc (mg/L)	Q
REMEDIATION GOAL					0.05											
Surface Water/Effluent																
Effluent 1	0.76		7.71		0.0126		131		123		958		0.0183		0.0226	
Effluent 2	0.76		7.95		0.013		134		122		988		0.0181		0.0241	
Effluent 3	0.76		7.95		0.0124		135		122		970		0.0187		0.024	
Soda Down	0.07		13.8		0.0112	J-	53.9		116	J	976	J	0.0024	B	0.0031	B
Soda Down Weir	0.11		8.05		0.001	B	26.3		38		572		0.002	B	<0.003	U
Soda Up	0.08		8.09		0.00042	B	21.6		36.5		550		0.0017	B	<0.003	U
Pond Inlet	0.75		10.5		0.0107		1300		123		4,020		0.0186		0.0295	

Notes:
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na: not analyzed

J - The result is an estimated value.

UJ - The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise
U - The analyte was not detected at the method detection limit.

TABLE 8

Constituent Concentration Trends at Point of Compliance Wells and Soda Creek

Location	Formation	Cadmium	Fluoride	Manganese	Nitrate as N	Selenium		Chloride [a]	Molybdenum [a]	Sulfate [a]
Remediation Goal (mg/L)		0.005	4	0.18	10	0.05		n/a	n/a	n/a
Groundwater										
Production Wells										
PW-01	UBZ/LBZ	⇔ N	⇔ Y	⇔ Y	⇔ Y	⇔ Y		⇧	⇧	⇔
PW-02	UBZ/LBZ	⇩ Y	⇔ Y	⇔ Y	⇔ Y	⇔ Y		⇧	⇧	⇔
PW-03	UBZ/LBZ	⇔ Y	⇔ Y	⇔ Y	⇔ Y	⇔ Y		⇧	⇧	⇔
Southern Plant Fence Line										
TW-20	UBZ	⇔ N	⇧ Y	⇔ Y	⇧ N	⇩ N		⇔	⇧	⇧
TW-34	LBZ	⇔ Y	⇔ Y	⇔ N	⇔ Y	⇔ Y		⇔	⇔	⇔
TW-35	LBZ	⇔ Y	⇔ Y	⇔ Y	⇔ Y	⇔ Y		⇔	⇔	⇔
TW-39	UBZ	⇔ N	⇧ Y	⇔ Y	⇧ N	⇔ N		⇔	⇩	⇧
Southern Boundary										
TW-53	UBZ	⇔ Y	⇔ Y	⇔ Y	⇧ Y	⇩ N		⇧	⇔	⇧
TW-54	UBZ	⇔ Y	⇧ Y	⇔ Y	⇧ Y	⇩ N		⇔	⇧	⇔
TW-55	UBZ	⇔ Y	⇔ Y	⇔ Y	⇧ Y	⇧ Y		⇧	⇔	⇧
Mormon A Spring [b]	UBZ	⇧ N	⇔ Y	⇔ Y	⇧ Y	⇔ N		⇧	⇧	⇧
Harris Well	UBZ	⇔ Y	⇔ Y	⇔ Y	⇧ Y	⇩ N		⇧	⇔	⇧
Surface Water/Effluent Discharge										
Soda Creek										
Upstream of Effluent Discharge		⇔ Y	⇔ Y	⇧ Y	⇔ Y	⇔ Y		⇔	⇔	⇔
Downstream of Effluent Discharge		⇔ Y	⇔ Y	⇧ Y	⇔ Y	⇔ Y		⇔	⇔	⇔
Effluent Discharge		⇔	⇔	⇔	⇔	⇔		⇔	⇔	⇔

[a] Constituents included for illustrative purposes only, no remediation goal

[b] Proposed alternative point of compliance for Harris well

⇔	Concentrations relatively stable overall in the past 5 years (2002 to 2007)
⇩	Concentrations decreased overall in the past 5 years (2002 to 2007)
⇧	Concentrations increased overall in the past 5 years (2002 to 2007)
Y	Equal to or less than EPA Remediat on Goal in June 2007
N	Greater than EPA Remediation Goal in June2007

TABLE 9

Constituent Concentration Trends at Other Wells and Springs

Location	Formation	Cadmium	Fluoride	Manganese	Nitrate as N	Selenium	Chloride	Molybdenum	Sulfate
NW Pond									
TW-29	UBZ	⇔	⇔	⇔	⇔	⇔	⇔	⇔	⇔
TW-16	UBZ	⇔	⇔	⇔	⇧	⇩	⇧	⇔	⇔
TW-17	UBZ	⇔	⇔	⇧	⇔	⇔	⇩	⇔	⇩
TW-18	LBZ	⇔	⇔	⇔	⇔	⇔	⇔	⇔	⇔
Old UFS Pond Area									
TW-57	UBZ	⇔	⇔	⇔	⇔	⇔	⇔	⇔	⇔
TW-22	UBZ	⇔	⇔	⇩	⇔	⇩	⇔	⇩	⇔
TW-24	UBZ	⇔	⇧	⇔	⇧	⇩	⇧	⇔	⇔
TW-37	UBZ	⇧	⇩	⇔	⇧	⇩	⇧	⇩	⇧
TW-45	LBZ	⇔	⇔	⇩	⇔	⇔	⇔	⇔	⇔
UFS Piles Area									
TW-48	UBZ	⇔	⇔	⇔	⇧	⇔	⇔	⇩	⇔
TW-49	UBZ	⇔	⇔	⇔	⇔	⇔	⇔	⇔	⇔
TW-50	UBZ	⇩	⇔	⇧	⇔	⇔	⇧	⇔	⇧
Old Hydroclarifier									
TW-40	UBZ	⇔	⇔	⇔	⇧	⇩	⇧	⇔	⇧
TW-43	UBZ	⇔	⇔	⇔	⇔	⇩	⇔	⇩	⇔
TW-44	LBZ	⇔	⇔	⇔	⇔	⇔	⇔	⇔	⇧
Springs									
Homestead Spring	UBZ	⇔	⇔	⇔	⇧	⇔	⇔	⇔	⇔
Mormon A Spring	UBZ	⇧	⇔	⇔	⇧	⇩	⇔	⇔	⇧

⇔	Concentrations relatively stable overall in the past 5 years (2002 to 2007)
⇩	Concentrations decreased overall in the past 5 years (2002 to 2007)
⇧	Concentrations increased overall in the past 5 years (2002 to 2007)

TABLE 10

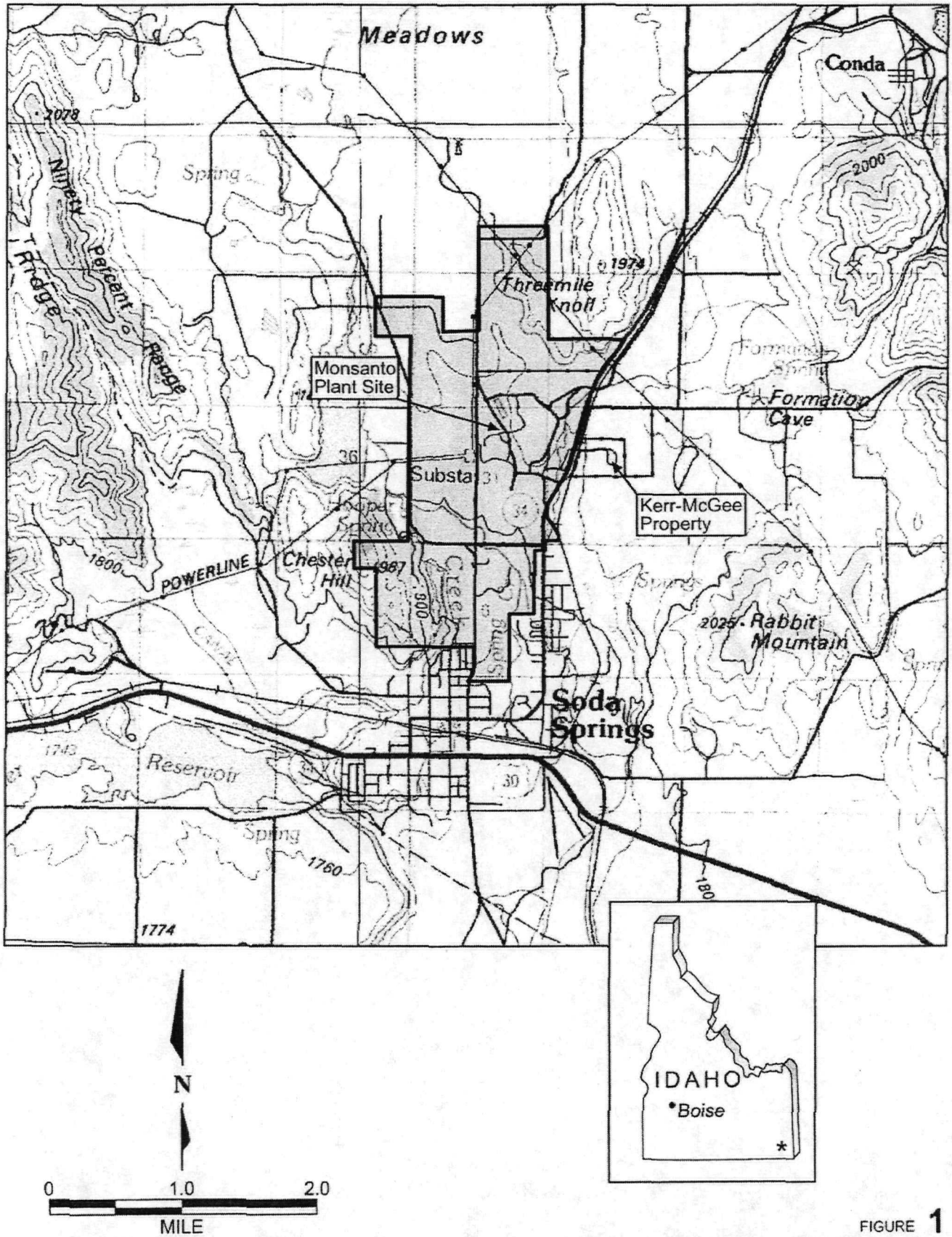
2007 Results Compared to Remediation Goals

Location	Cadmium (mg/L)	Q	Fluoride (mg/L)	Q	Manganese (mg/L)	Q	Nitrate and Nitrite as N (mg/L)	Q	Selenium (mg/L)	Q
REMEDIATION GOAL	**0.005**		**4**		**0.18**		**10**		**0.05**	
Groundwater										
Harris Well	0.00032	B	2.54		0.0026	B	8.96		**0.123**	
PW-01	**0.0314**		0.89		<0.0007	U	4.56		0.0167	
PW-02	0.0016	B	0.46		<0.0007	U	3.74		0.0064	
PW-03	0.0014	B	0.21		<0.0007	U	3.64		0.0043	
PW-04	<0.0003	U	0.41		<0.0008	U	4.23		0.003	U
TW-20	**0.0068**		2.05	J	<0.0009	U	**10.5**		**0.0847**	
TW-20 (Duplicate)	**0.0052**		3.09	J	<0.0007	U	**11.4**		**0.0798**	
TW-34	<0.0003	U	0.6	J	**0.222***		0.034		0.0011	
TW-35	<0.0003	U	<0.1	UJ	0.158		0.023		0.003	U
TW-35 (Split)	<0.0002	U	<1	U	0.151		<0.01	U	<0.002	U
TW-39	**0.0093**		3.34	UJ	<0.0007	UJ	9.56		**0.125**	
TW-53	<0.0006	U	2.92	UJ	<0.0007	UJ	7.15		**0.115**	
TW-54	<0.0006	U	3.66	UJ	<0.0007	UJ	9.7		**0.0849**	
TW-54 (duplicate)	<0.0006	U	3.68	UJ	<0.0007	UJ	9.69		**0.085**	
TW-55	<0.0006	U	0.26	UJ	<0.0007	UJ	4.15		0.0413	
TW-55 (split)	<0.0002	U	<1	U	<0.001	UJ	3.88		0.12	
Surface Water										
Soda Down	<0.0006	U	0.71		0.114		0.993		0.0112	
Soda Up	<0.0006	U	0.51		0.125		0.304		0.00042	B

Note: Results in bold indicate remediation goal is exceeded.

* natural background

FIGURES



SOURCE: Topographic map of the USGS Soda Springs Quadrangle (1:100,000) 1982.

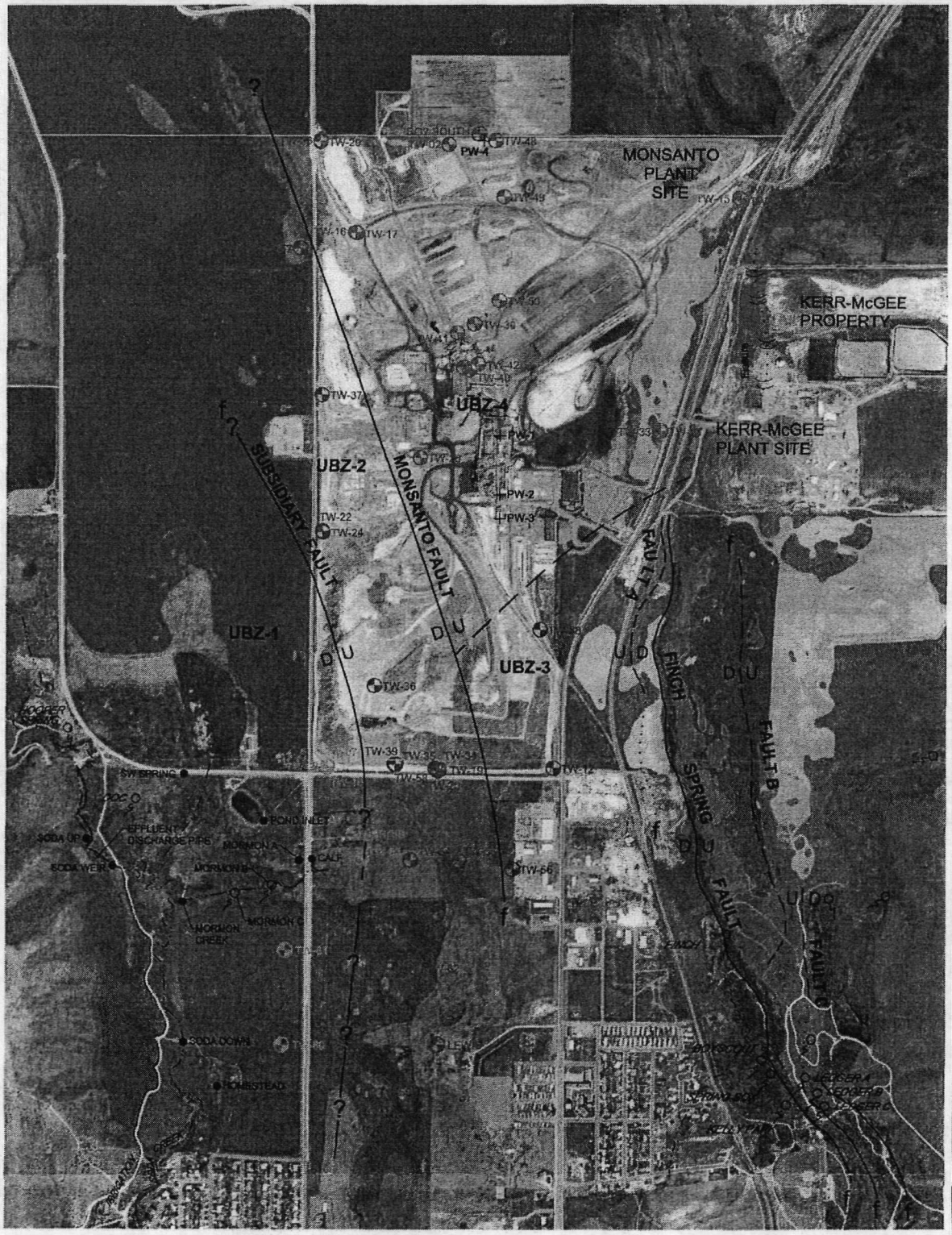
FIGURE 1

MONSANTO PLANT VICINITY MAP

MONSANTO/2007 ANNUAL REPORT/ID

DRAWING NO. 9131101001605afig01.ai DATE 10/05/07 DRAWN BY

Golder Associates



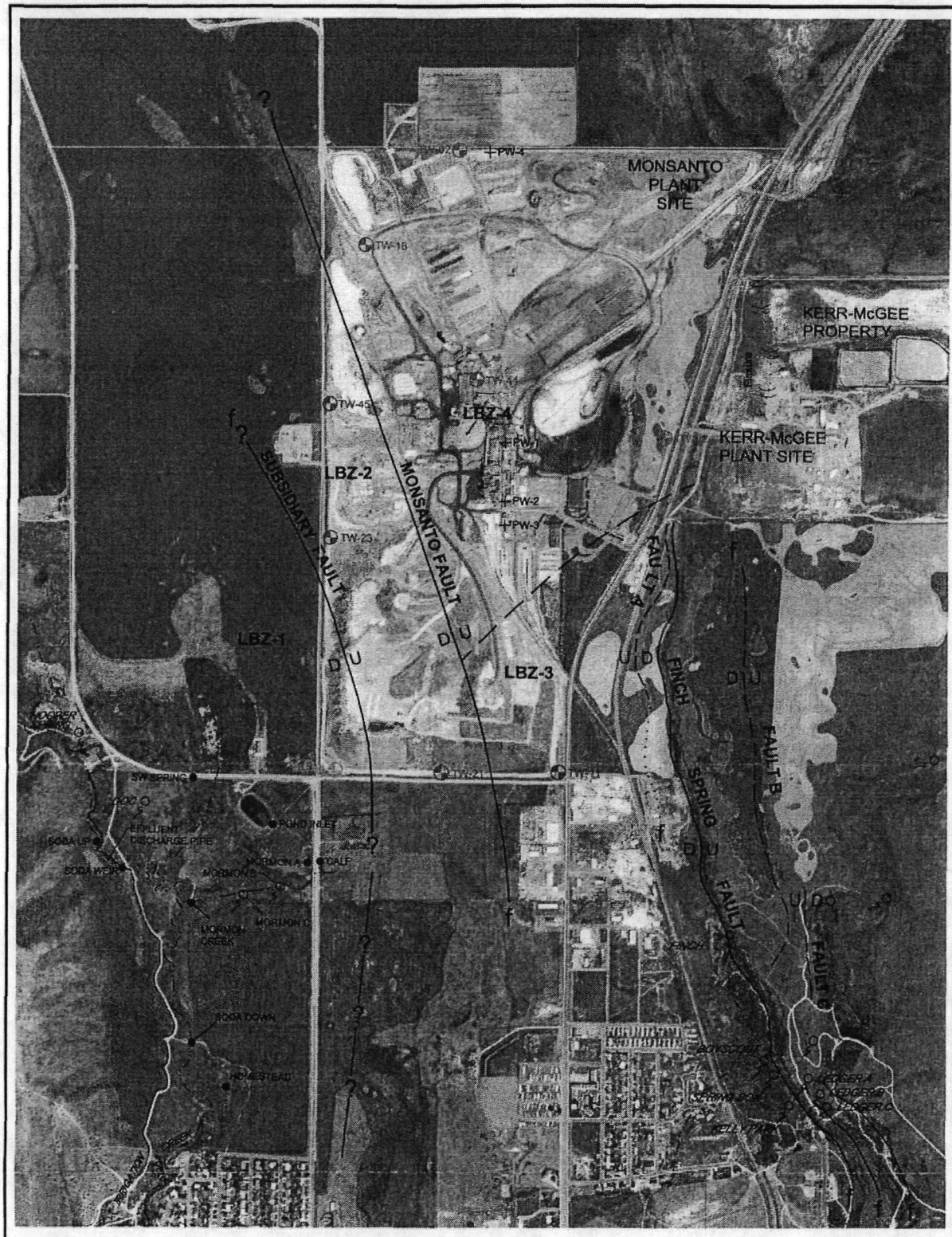
LEGEND

TW-07	Monitoring well location and name in Groundwater Zone UBZ 1
TW-35	Monitoring well location and name in Groundwater Zone UBZ 2
TW-12	Monitoring well location and name in Groundwater Zone UBZ 3
TW-49	Monitoring well location and name in Groundwater Zone UBZ 4
● SODA UP	Spring or surface water sample location and name
+PW-1	Production well location and name
LEDGER A	Spring location and name (where known)
UBZ-1	Groundwater Zones
f —?— D/U —?— — · — f	Fault (dashed where inferred)

FIGURE 2
LOCATION OF SPRINGS & WELLS IN UPPER BASALT ZONE
MONSANTO/2007 ANNUAL REPORT/ID

K:\CAD\Projects\1991\9131191\605\913_1101_805_F23_A.dwg | FIG 2 | Mod: 11/01/2007, 13:43 | Plotted: 11/02/2007, 13:32 | aforcier

Golder Associates



LEGEND

TW-07	Monitoring well location and name in Groundwater Zone LBZ 1
TW-35	Monitoring well location and name in Groundwater Zone LBZ 2
TW-12	Monitoring well location and name in Groundwater Zone LBZ 3
TW-49	Monitoring well location and name in Groundwater Zone LBZ 4
● SODA UP	Spring or surface water sample location and name
+PW-1	Production well location and name
LEDGER A	Spring location and name (where known)
LBZ-1	Groundwater Zones
f —?— D/U —?— — · — f	Fault (dashed where inferred)

0 300 600 METERS
0 1000 2000 FEET

FIGURE 3
LOCATION OF WELLS IN LOWER BASALT ZONE
MONSANTO/2007 ANNUAL REPORT/ID

K:\CAD\Projects\1991\9131101\605\913_1101_605_F28_A.dwg | FIG 3 | Mod: 11/01/2007, 15:36 | Plotted: 11/02/2007, 13:32 | eforder

Golder Associates

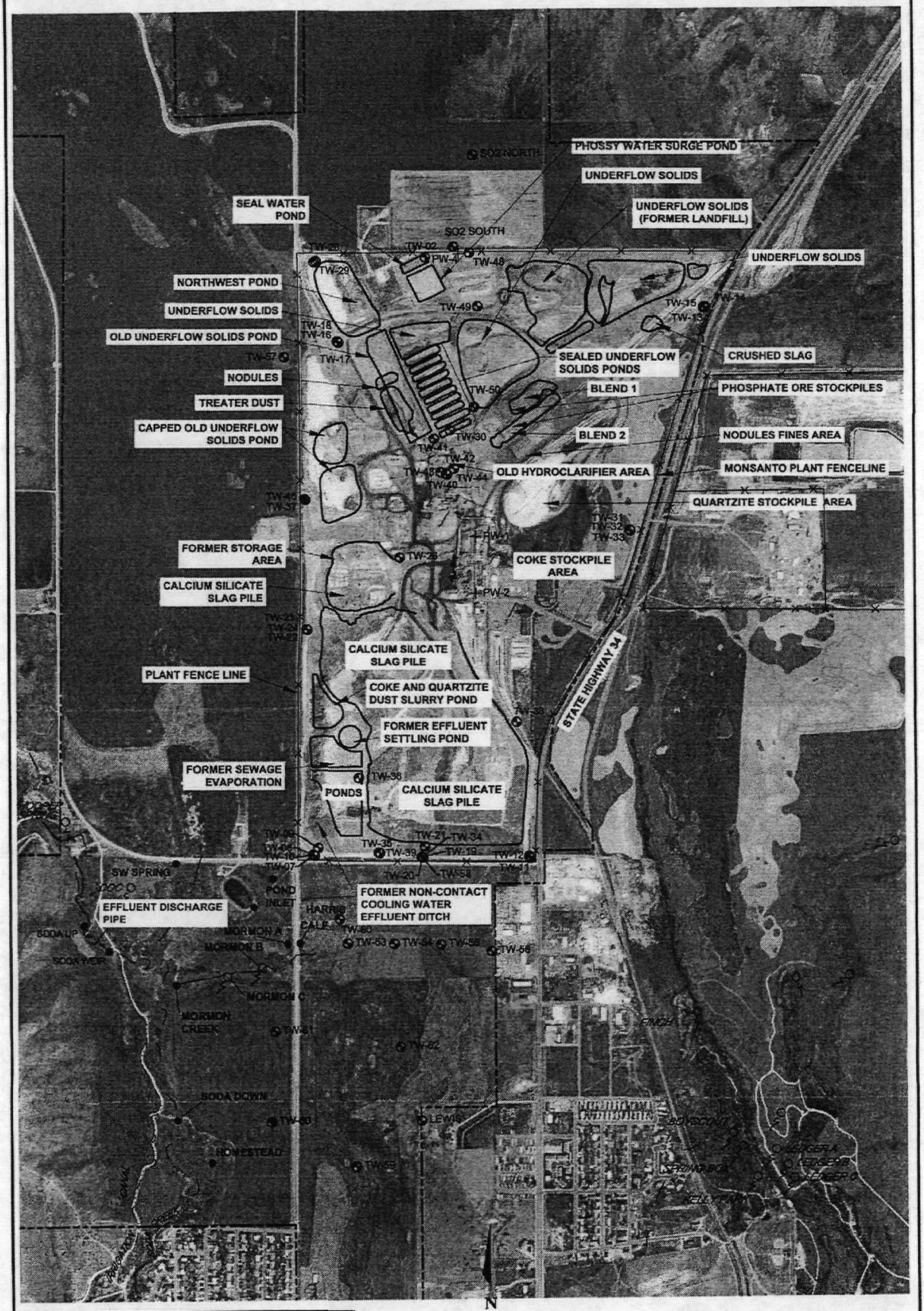
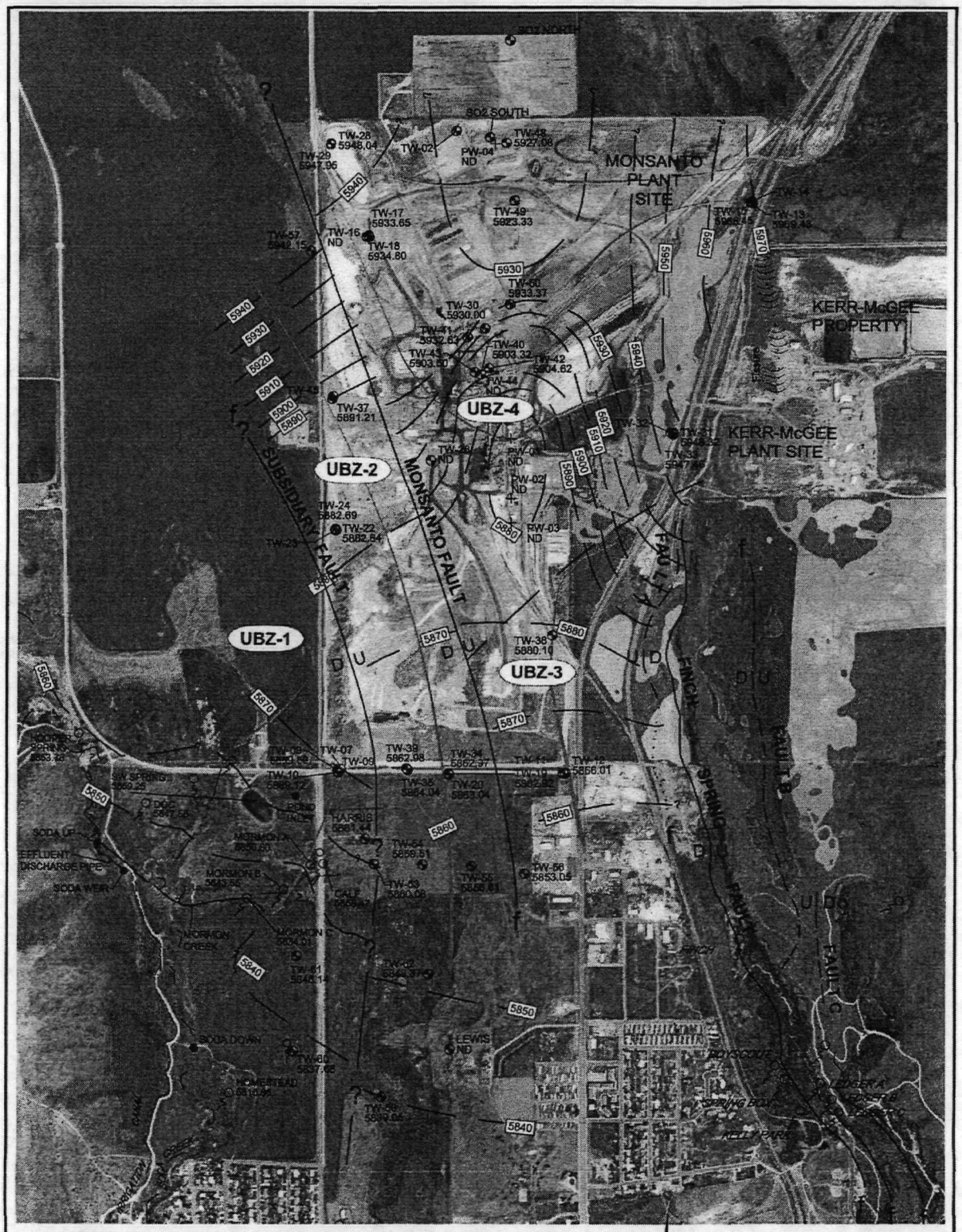


FIGURE 4
MONSANTO FACILITY MAP
MONSANTO/2007 ANNUAL REPORT/ID

Golder Associates



LEGEND

TW-26	Monitoring well location and name
PW-03	Production well location and name
BOYSCOUT	Spring location and name with water surface elevation
5872	Groundwater elevation (ft)
ND	No data
5870	Groundwater elevation contour (10 ft interval)
	Groundwater flow direction
f — ? D/U ? — f	Fault (dashed where inferred)

N

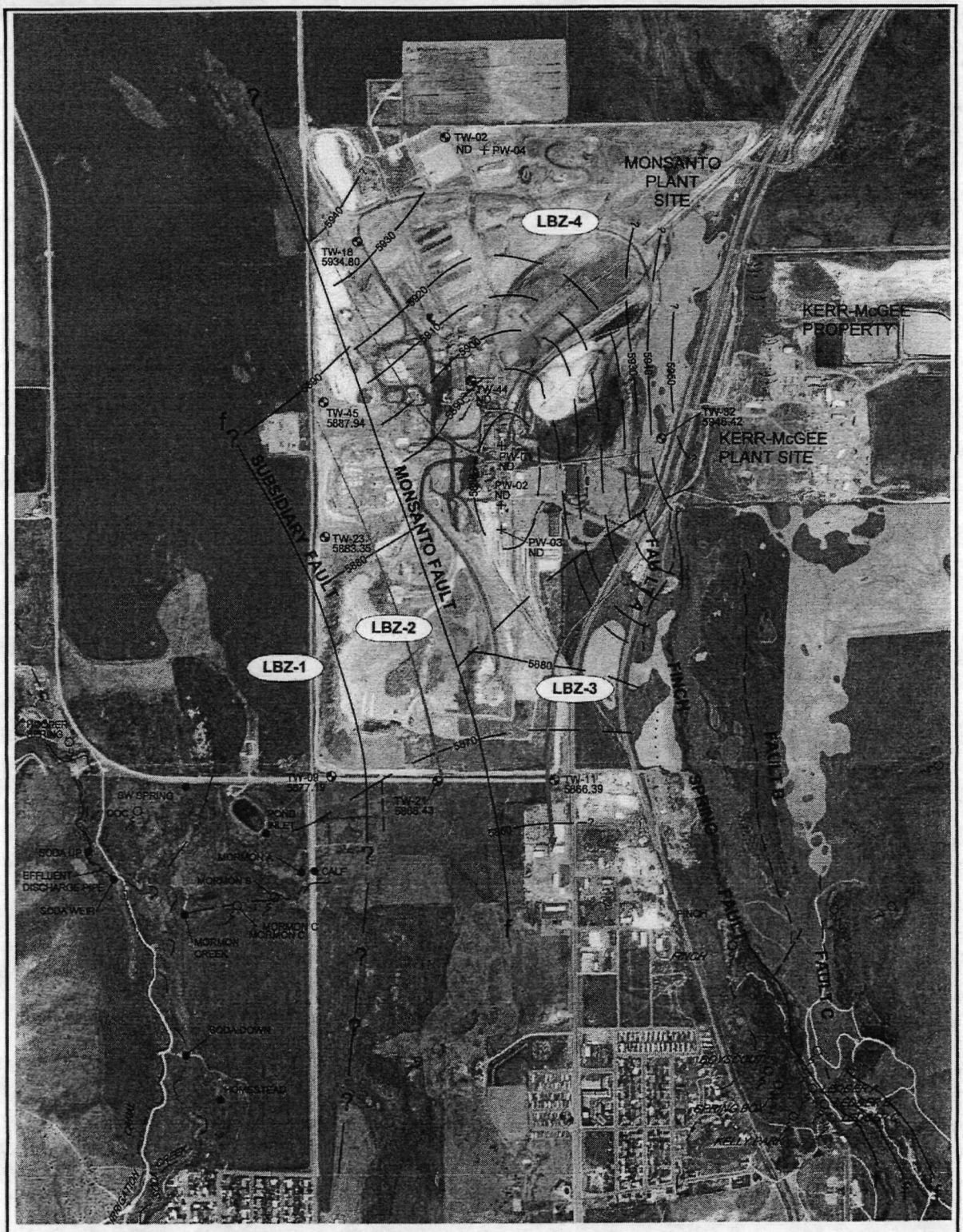
0 300 600 METERS
0 1000 2000 FEET

NOTE:
PW-1, PW-2, PW-3 and PW-4 are open to both the Upper and Lower Basalt Zones.

FIGURE 5
GROUNDWATER ELEVATION OF THE UPPER BASALT ZONE JULY 2007
MONSANTO/2007 ANNUAL REPORT/ID

K:\CAD\Projects\1991\9131101\605\913110605F24R1.dwg | 11x17 | Mod: 11/29/2007, 14:14 | Plotted: 11/29/2007, 14:18 | jrubio

Golder Associates



LEGEND

TW-26	Monitoring well location and name
PW-03	Production well location and name
BOYSCOUT	Spring location and name
5872	Groundwater elevation (ft)
ND	No data
5870	Groundwater elevation contour (10 ft interval)
	Groundwater flow direction
f —?— D/U —?— f	Fault (dashed where inferred)

N

0 300 600 METERS

0 1000 2000 FEET

NOTE:
PW-1, PW-2, PW-3 and PW-4 are open to both the Upper and Lower Basalt Zones.

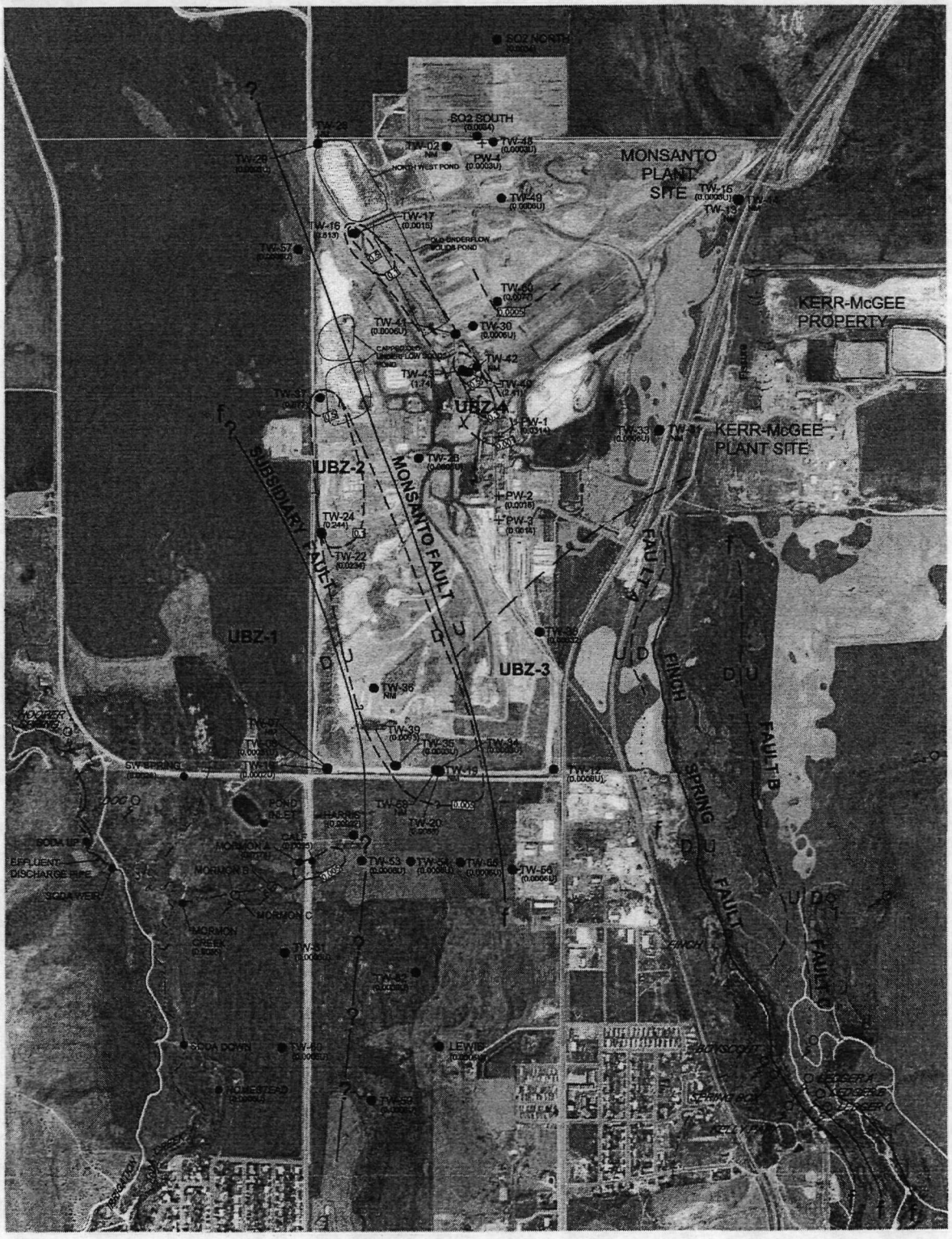
FIGURE 6

GROUNDWATER ELEVATION OF THE LOWER BASALT ZONE JULY 2007

MONSANTO/2007 ANNUAL REPORT/ID

K:\CAD\Projects\1991\9131101\605\9131101605F25R1.dwg | 11x17 | Mod: 11/29/2007, 14:21 | Plotted: 11/29/2007, 14:23 | jnuble

Golder Associates



LEGEND

--- 1.0 ---	CHEMICAL ISOPLETH (mg/L), DASHED WHERE APPROXIMATE, QUERIED WHERE UNKNOWN
● (1.838)	SAMPLE LOCATION WITH CHEMICAL CONCENTRATION (mg/L) *IN PARENTHESIS WITH QUALIFIER (IF ANY).* SAMPLES COLLECTED JUNE/JULY 2007.
	ORIGINAL SOURCE AREA
+	PRODUCTION WELL LOCATION
	SPRING LOCATION
f —?— D/U —?— f	FAULT (DASHED WHERE INFERRED)
UBZ-1	GROUNDWATER ZONES

N

0 300 600 METERS

0 1000 2000 FEET

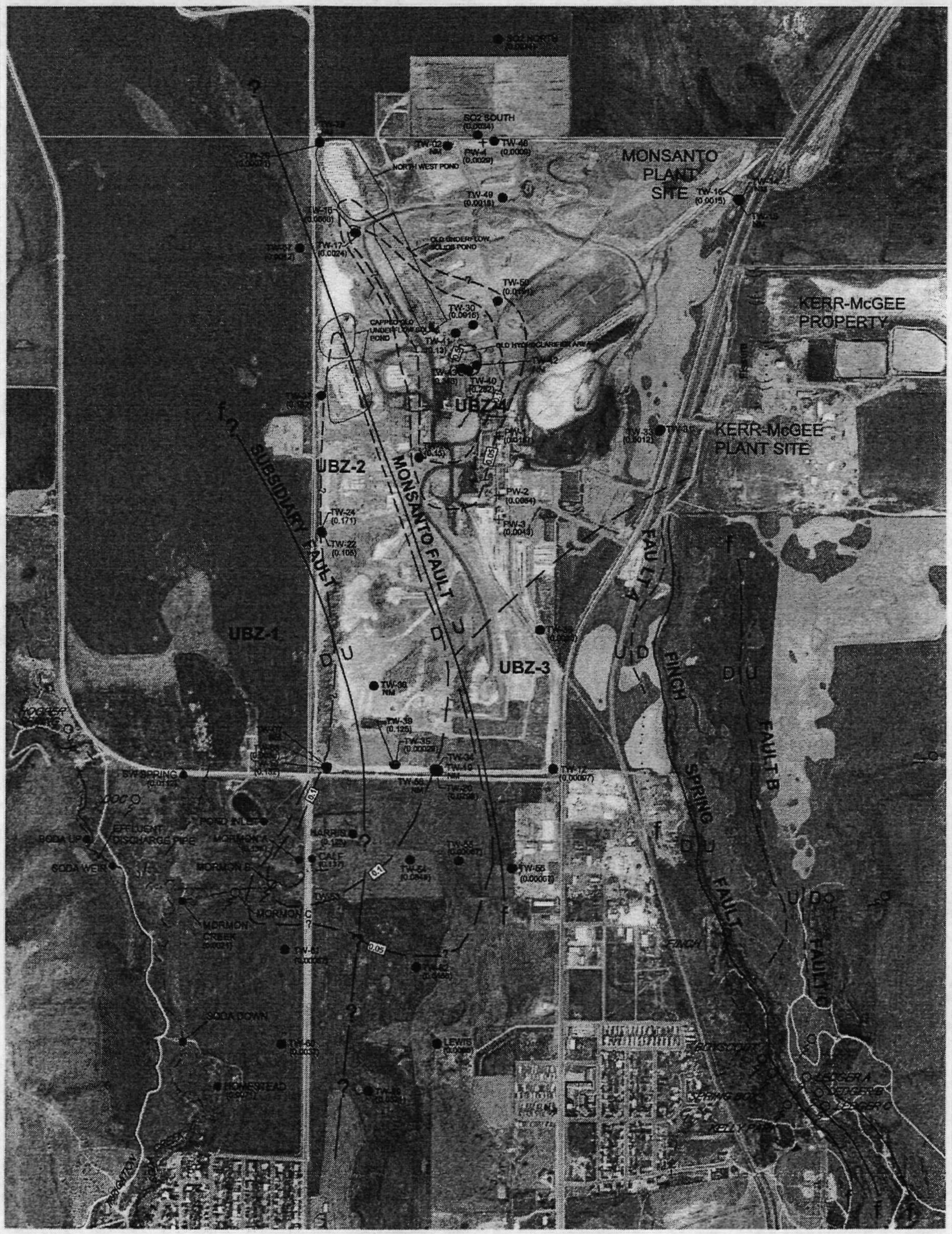
FIGURE 7

CADMIUM (JUNE/JULY 2007)
UPPER BASALT ZONE

MONSANTO/2007 ANNUAL REPORT/ID

K:\CAD\Projects\1991\9131101\605\9131101605F21R1.dwg | FIGURE 1 | Mod: 11/02/2007, 12:29 | Plotted: 11/02/2007, 13:30 | elomier

Golder Associates



LEGEND

— — — 1.0 — — —	CHEMICAL ISOPLETH (mg/L), DASHED WHERE APPROXIMATE, QUERIED WHERE UNKNOWN
●(1.638)	SAMPLE LOCATION WITH CHEMICAL CONCENTRATION (mg/L) IN PARENTHESIS WITH QUALIFIER (IF ANY). SAMPLES COLLECTED JUNE/JULY 2007
●(NM)	NOT MEASURED
	ORIGINAL SOURCE AREA
+	PRODUCTION WELL LOCATION
	SPRING LOCATION
f —?- D/U -?- - -f	FAULT (DASHED WHERE INFERRED)
UBZ-1	GROUNDWATER ZONES

N

0 300 600 METERS
0 1000 2000 FEET

FIGURE **8**

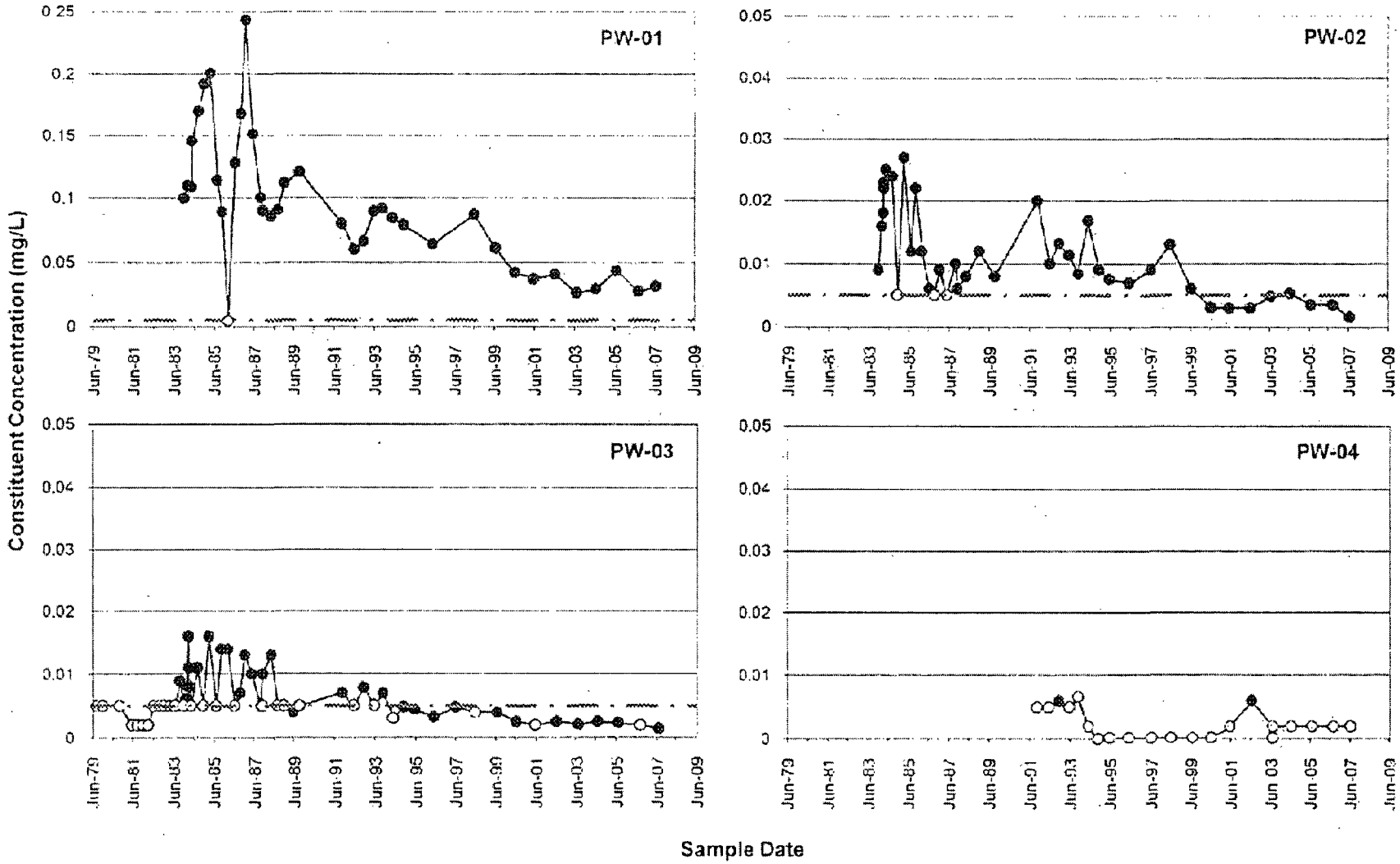
SELENIUM (JUNE/JULY 2007)
UPPER BASALT ZONE
MONSANTO/2007 ANNUAL REPORT/ID

K:\CAD\Projects\1991\913110\0605\913_1101_605_F22_R2.dwg | FIGURE 1 | Mod: 11/02/2007, 12:20 | Plotted: 11/02/2007, 13:21 | aforcier

Golder Associates

APPENDIX A

TIME-HISTORY GRAPHS FOR CADMIUM



FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

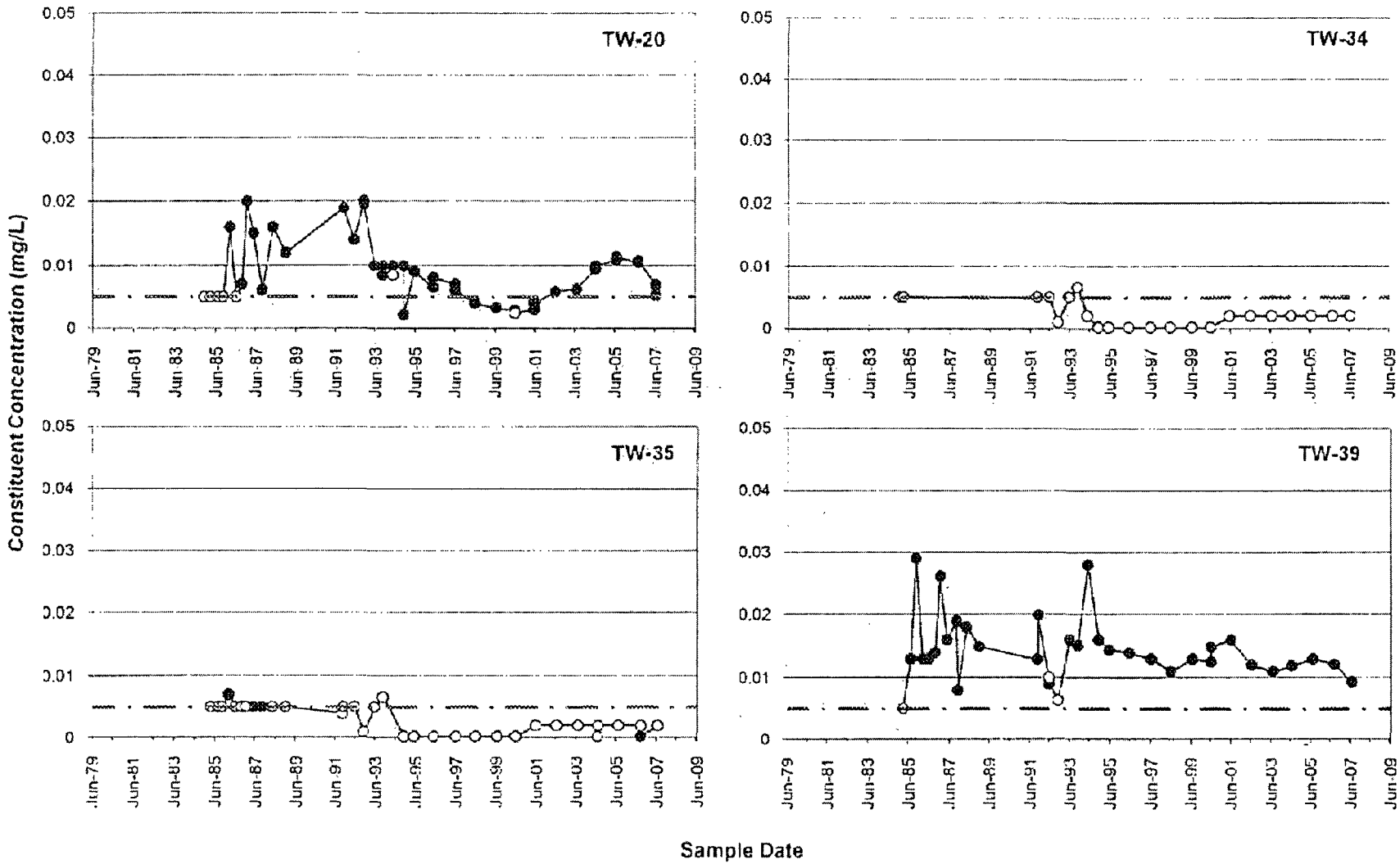
TITLE

Cadmium in Production Wells

FIGURE A-1

Constituent Concentration (mg/L)
Non-Detects
Cadmium Remediation Goal (0.005 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101 505A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

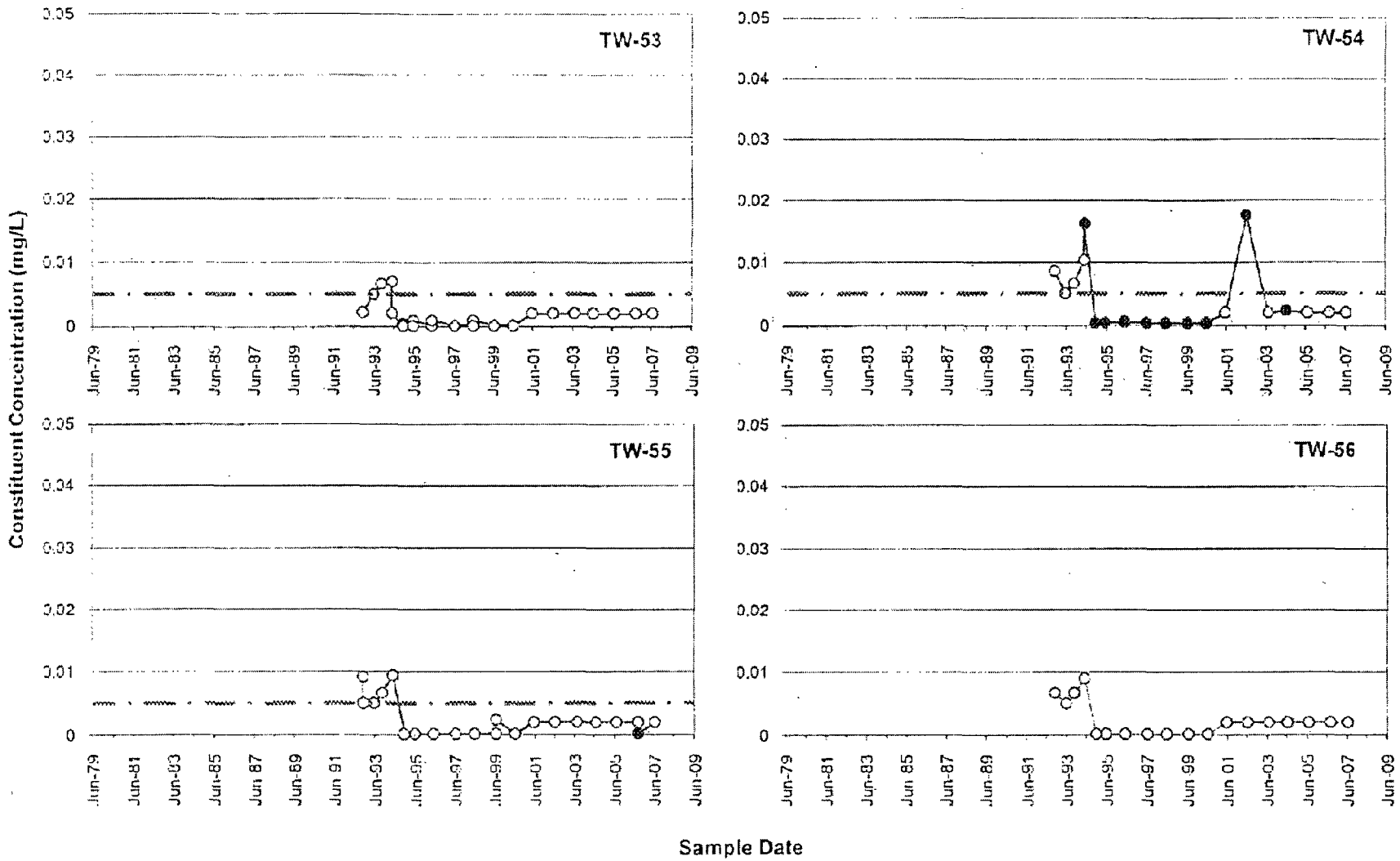
Golder Associates

TITLE **Cadmium in South Fenceline Wells**

FIGURE A-2

Constituent Concentration (mg/L)
Non-Detects
Cadmium Remediation Goal (0.005 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App A Cadmium Charts 2007 xls

Remediation goals shown for point of compliance locations only

Golder Associates

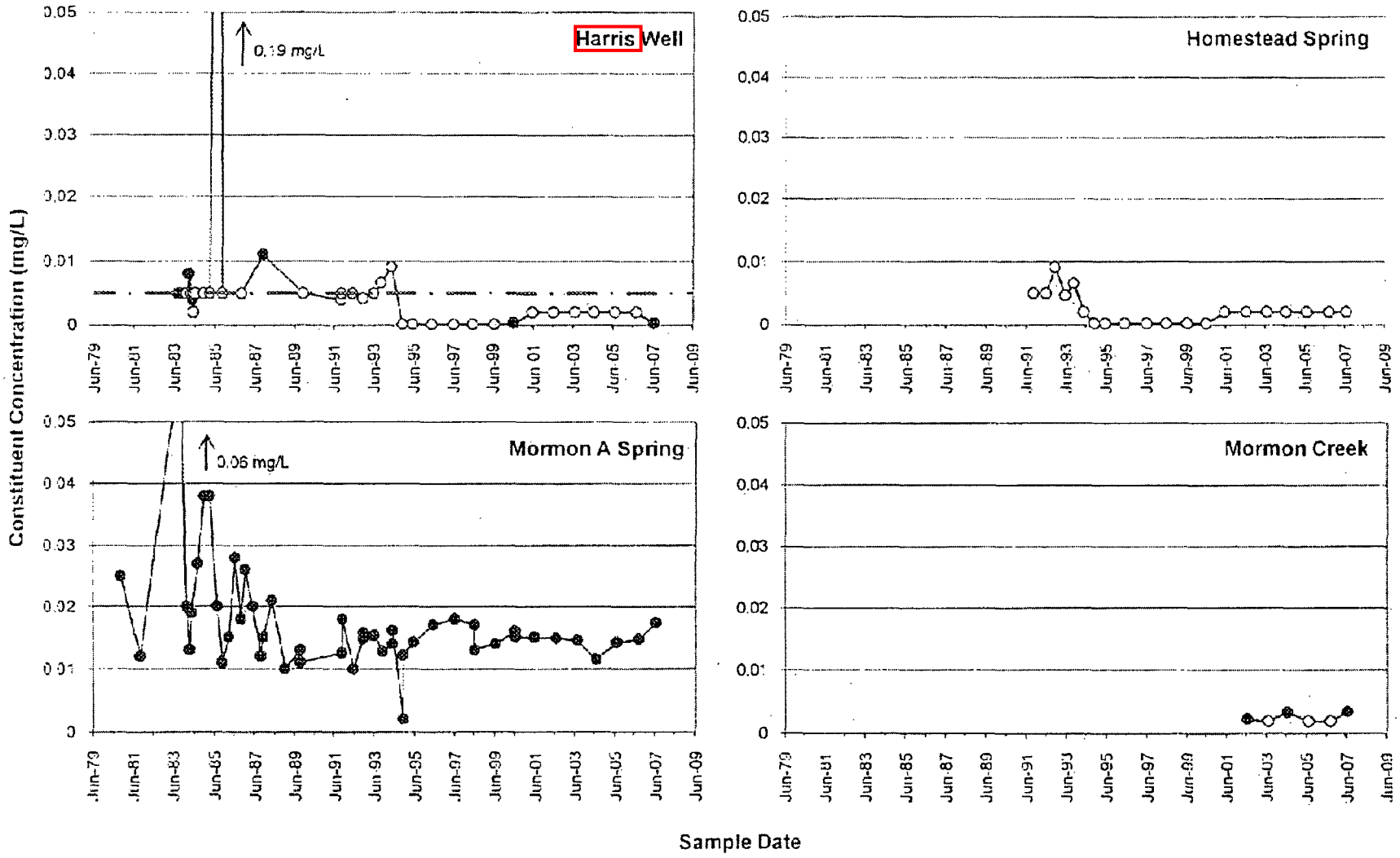
TITLE **Cadmium in Southern Boundary Wells**

FIGURE A-3

Constituent Concentration (mg/L)
Non-Detects
Cadmium Remediation Goal (0.005 mg/L)

CLIENT	Monsanto Company		
PROJECT	Monsanto Groundwater Monitoring		
PROJECT NO	913-1101.605A	DATE 29-Nov-07	

DRAWN	DH
CHECKED	MFK
REVIEWED	DB



FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

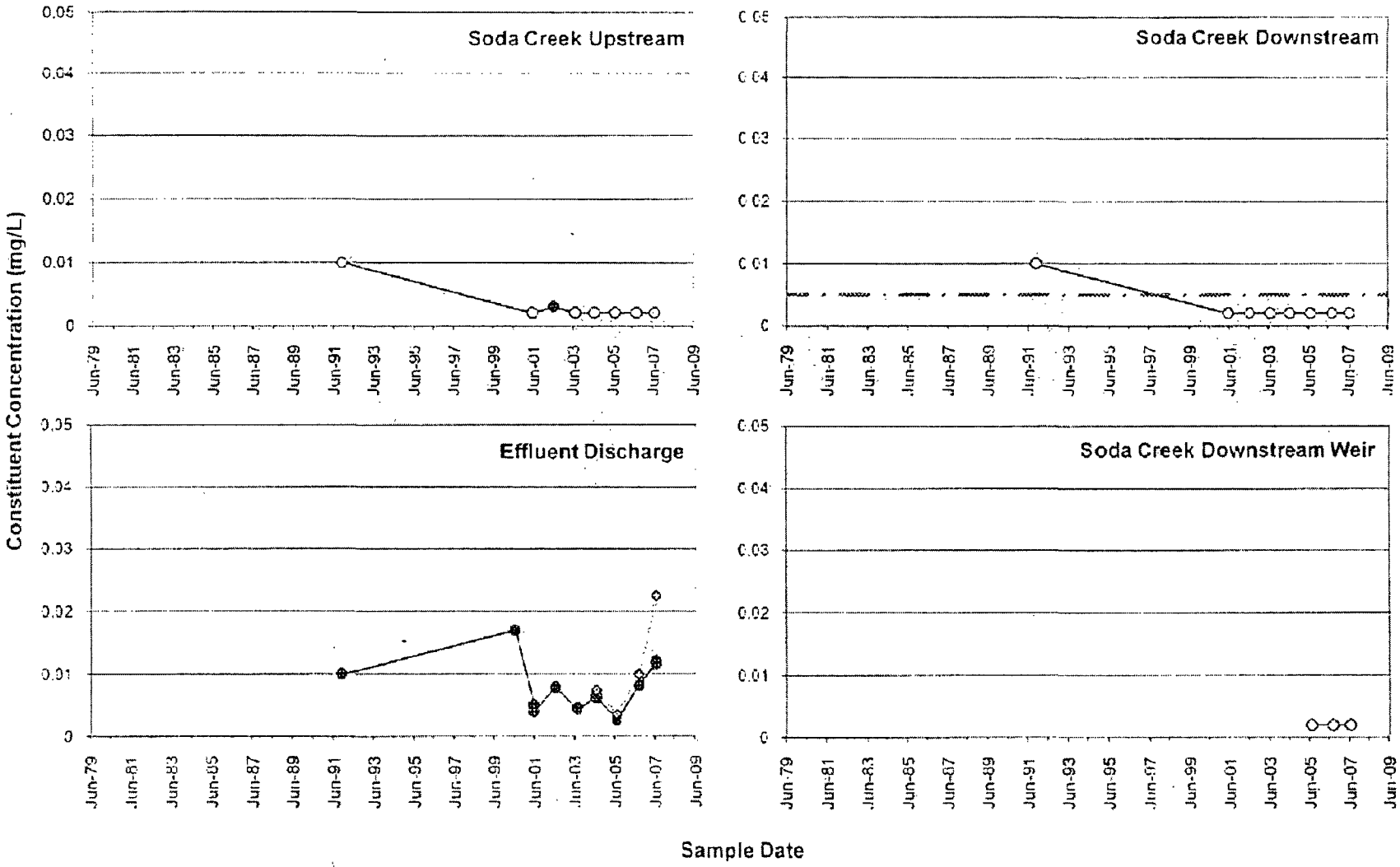
Cadmium in Harris Well and Springs South of Plant

FIGURE A-4

Constituent Concentration (mg/L)
Non-Detects
Cadmium Remediation Goal (0.005 mg/L)

CLIENT	Monsanto Company		
PROJECT	Monsanto Groundwater Monitoring		
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	

DRAWN	DH
CHECKED	MPK
REVIEWED	DB



FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

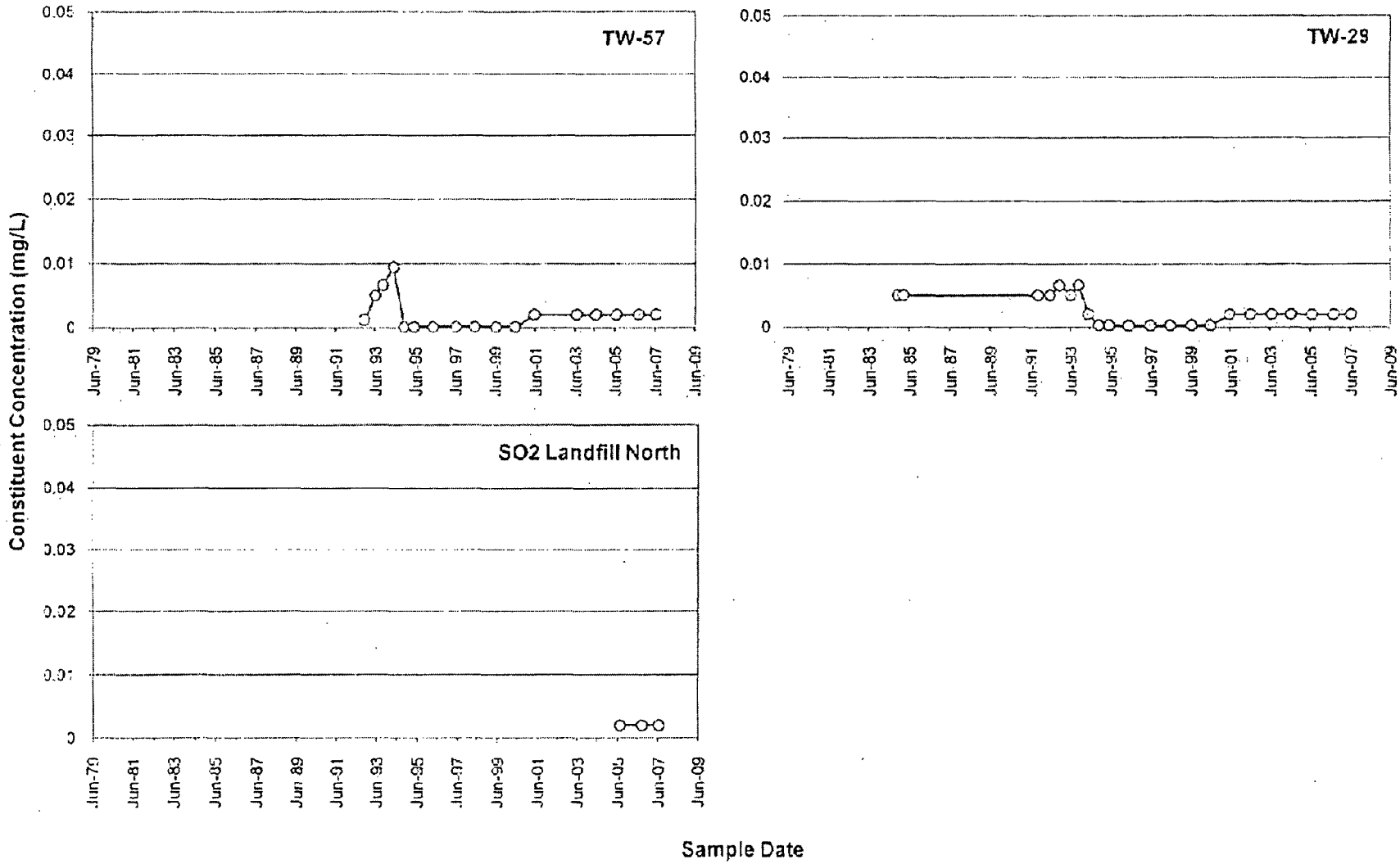
Golder Associates

TITLE **Cadmium in Soda Creek and Treatment Plant Effluent**

FIGURE A-5

Constituent Concentration (mg/L)
Non-Detects
Cadmium Remediation Goal (0.005 mg/L)
Pond Inlet

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

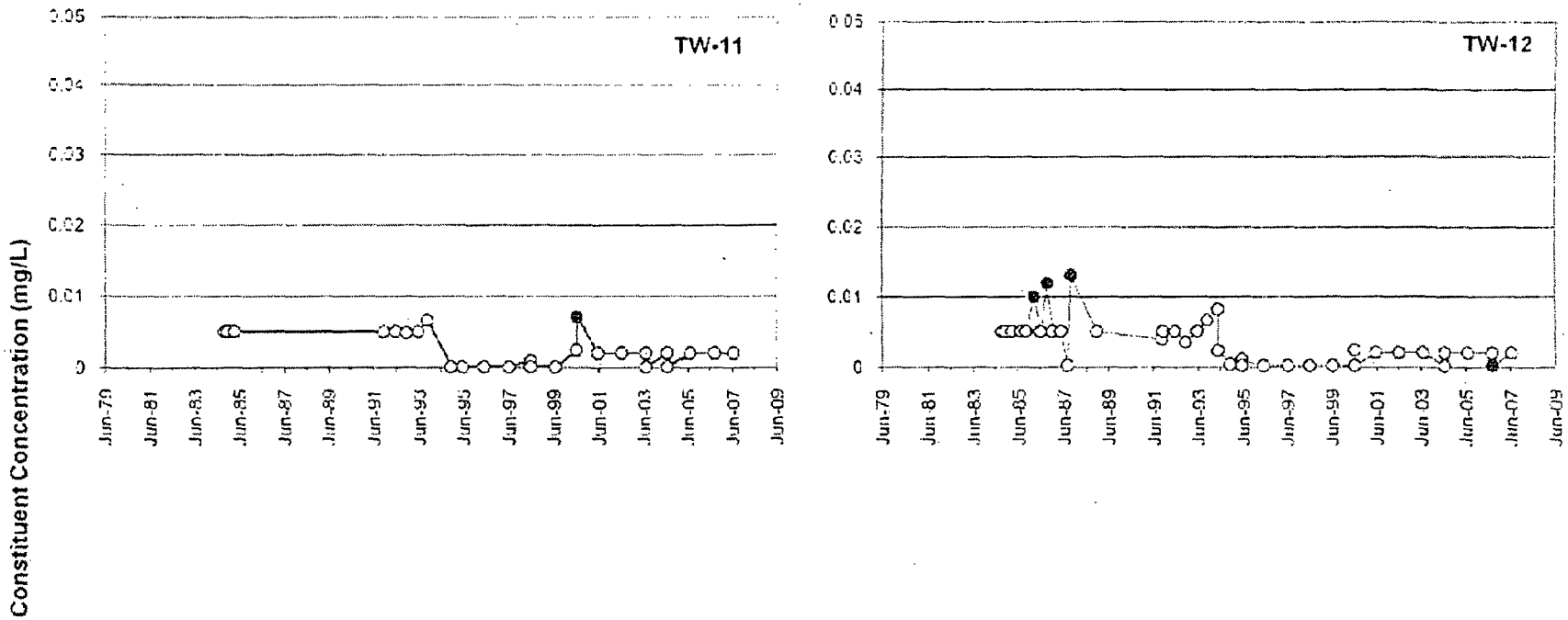
TITLE **Cadmium in Background Area Wells**

FIGURE **A-10**

—●— Constituent Concentration (mg/L)

—○— Non-Detects

CLIENT	Monsanto Company		DRAWN DH
PROJECT	Monsanto Groundwater Monitoring		CHECKED MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



Sample Date

FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

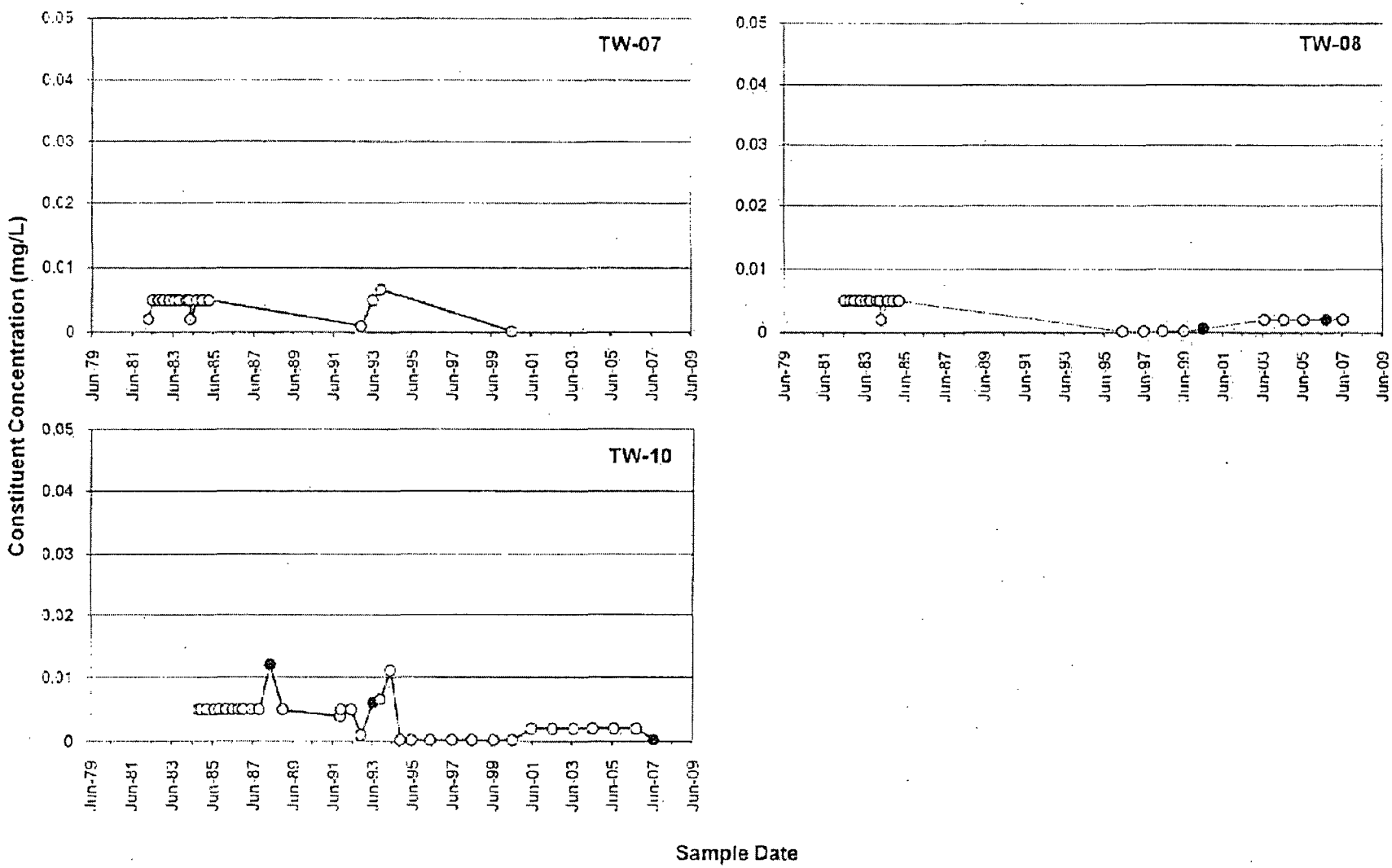
TITLE **Cadmium in Southeast Corner Wells**

FIGURE A-11

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

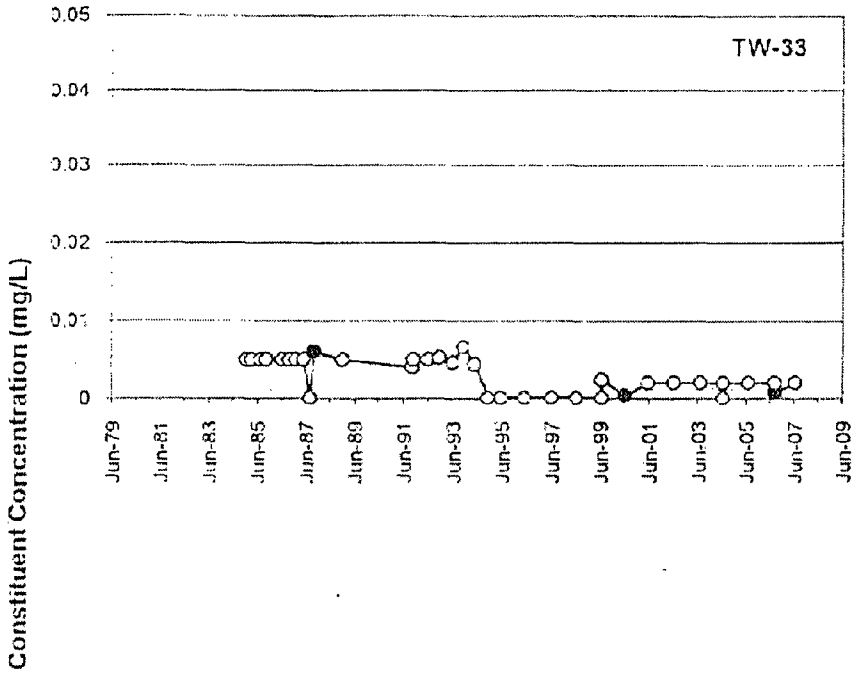
TITLE **Cadmium in Southwest Wells**

FIGURE A-12

Constituent Concentration (mg/L)

C Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



Sample Date

FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

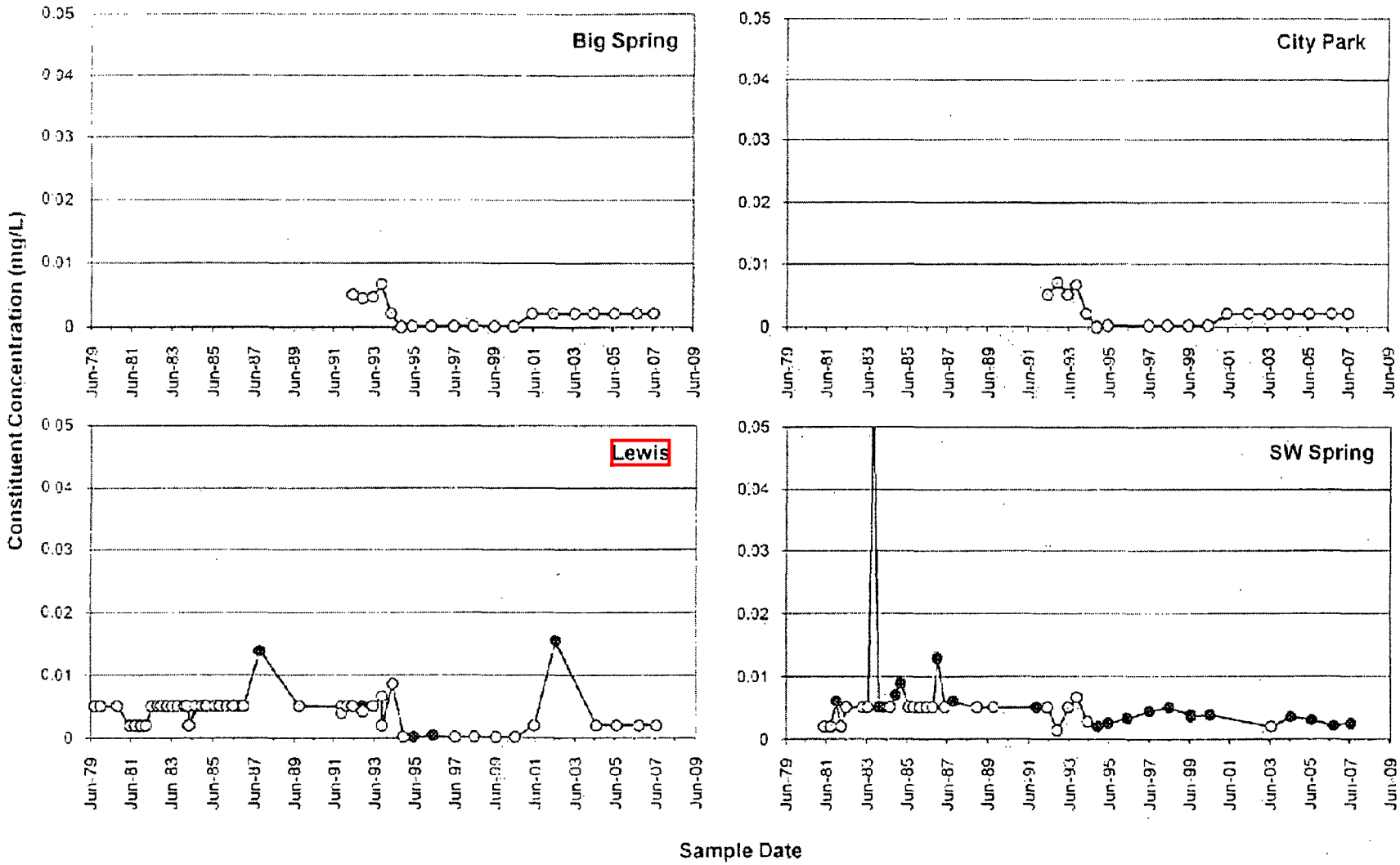
TITLE: Cadmium in East Area Wells

FIGURE A-13

—◆— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

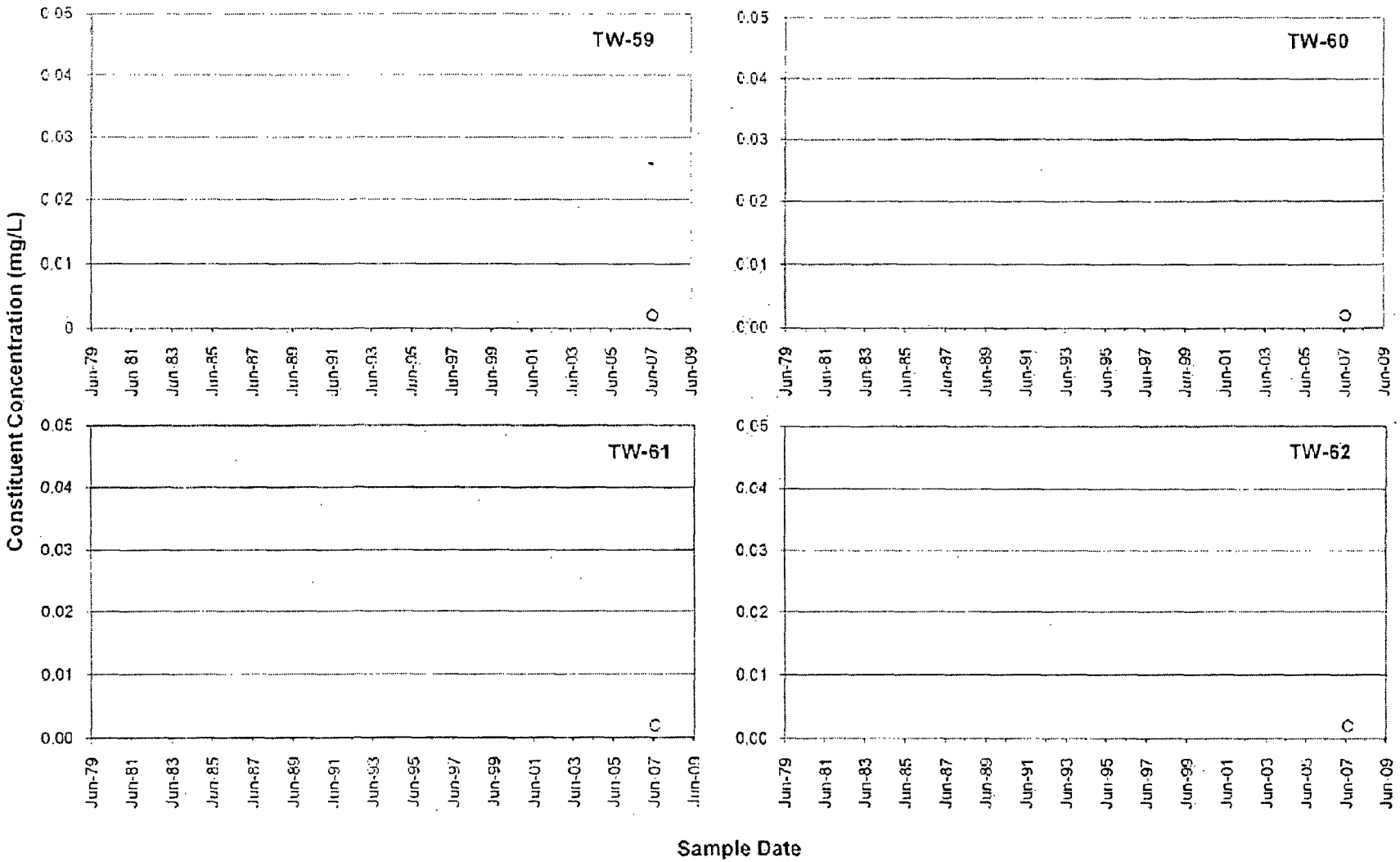
Cadmium in Off-Site Wells and Springs

FIGURE A-14

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App A Cadmium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE: Cadmium in 2007 Monitoring Wells

FIGURE A-15

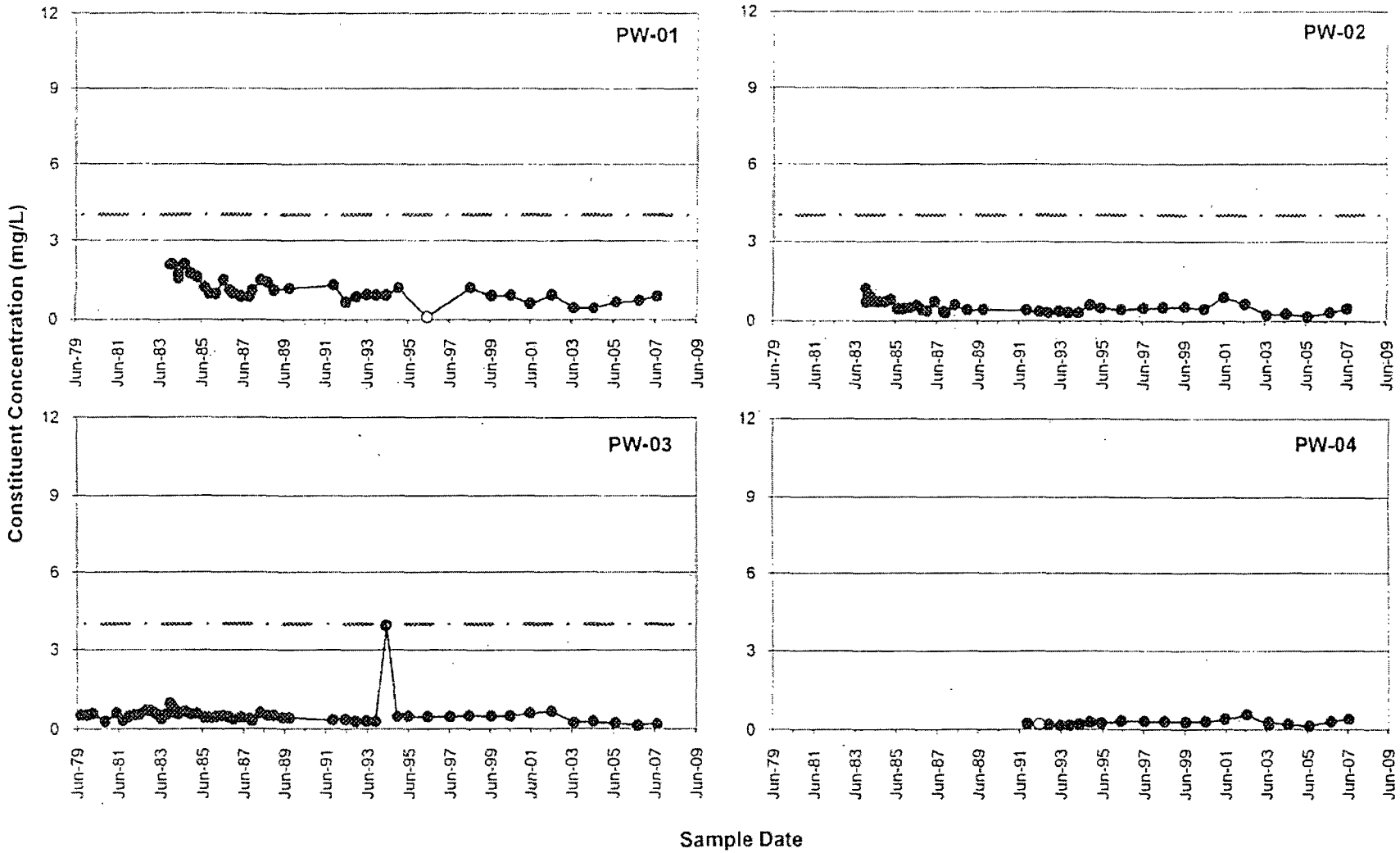
Constituent Concentration (mg/L)

non-detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB

APPENDIX B

TIME-HISTORY GRAPHS FOR FLUORIDE



FILE NAME App B FLjonde Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

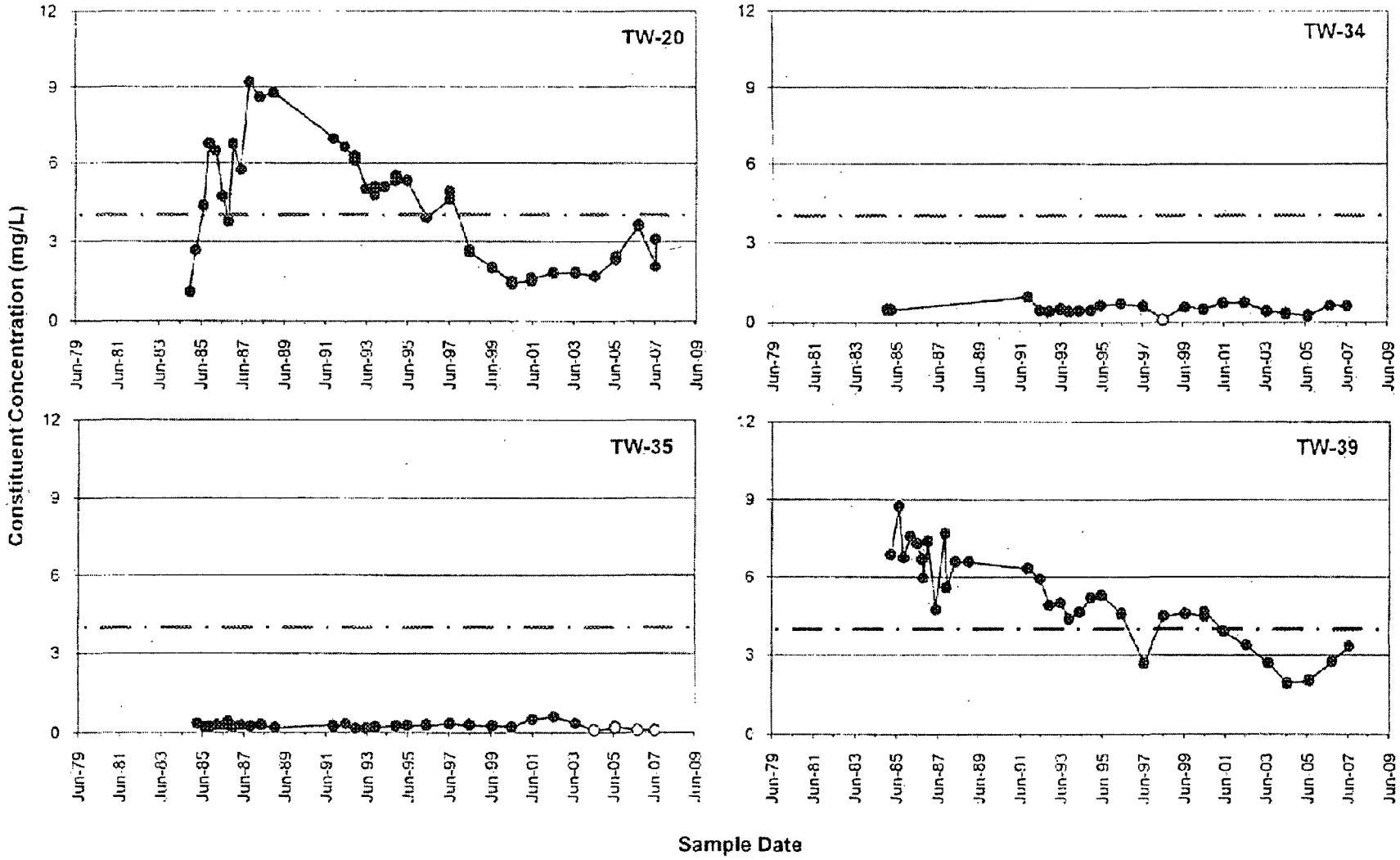
TITLE

Fluoride in Production Wells

FIGURE B-1

—●— Constituent Concentration (mg/L)
○ Non-Detects
— · — Fluoride Remediation Goal (4 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

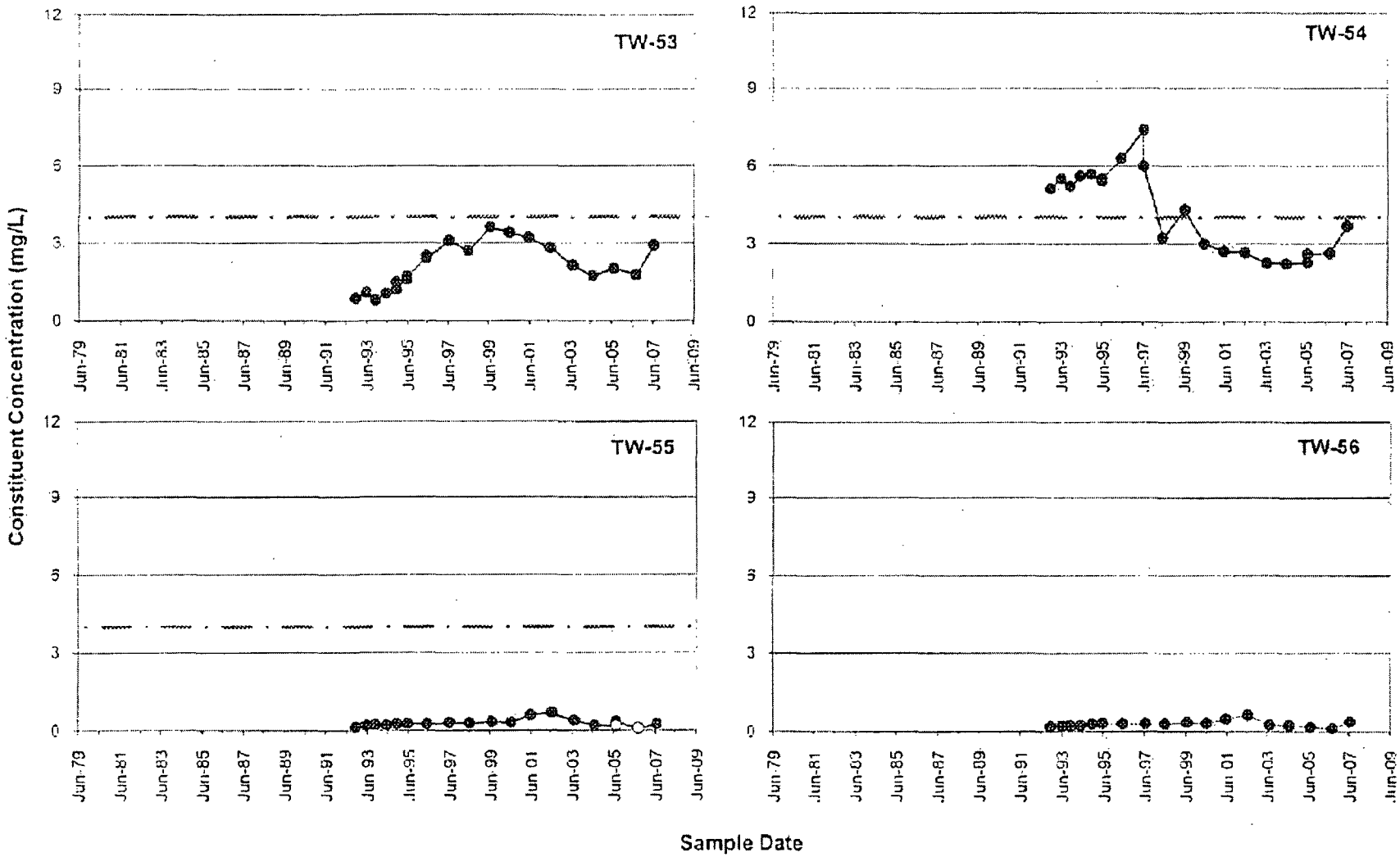
Golder Associates

TITLE **Fluoride in South Fenceline Wells**

FIGURE **B-2**

—●— Constituent Concentration (mg/L)
○ Non-Detects
— · — Fluoride Remediation Goal (4 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101 605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

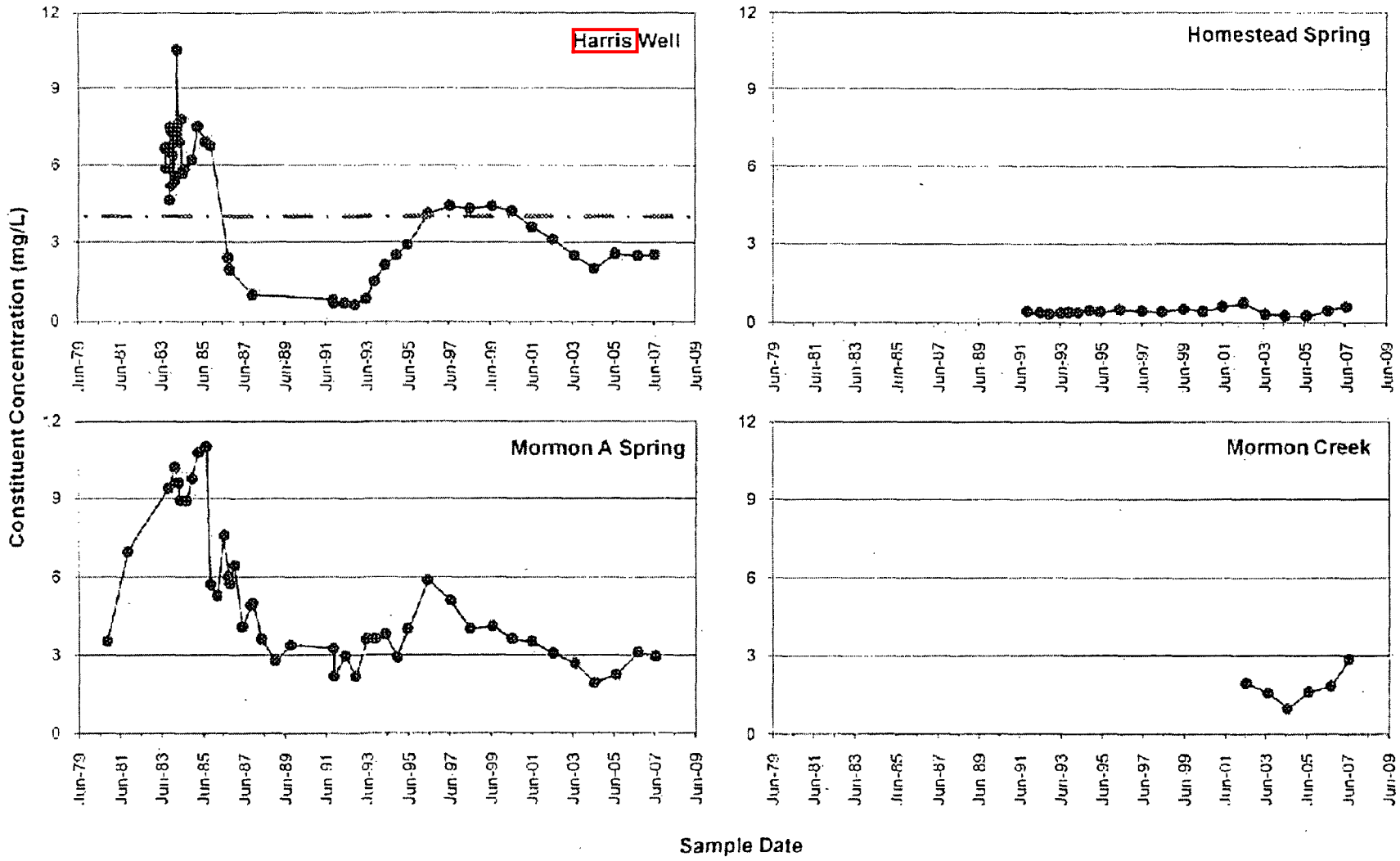
Golder Associates

TITLE **Fluoride in Southern Boundary Wells**

FIGURE B-3

Constituent Concentration (mg/L)
Non-Detects
Fluoride Remediation Goal (4 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101 605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

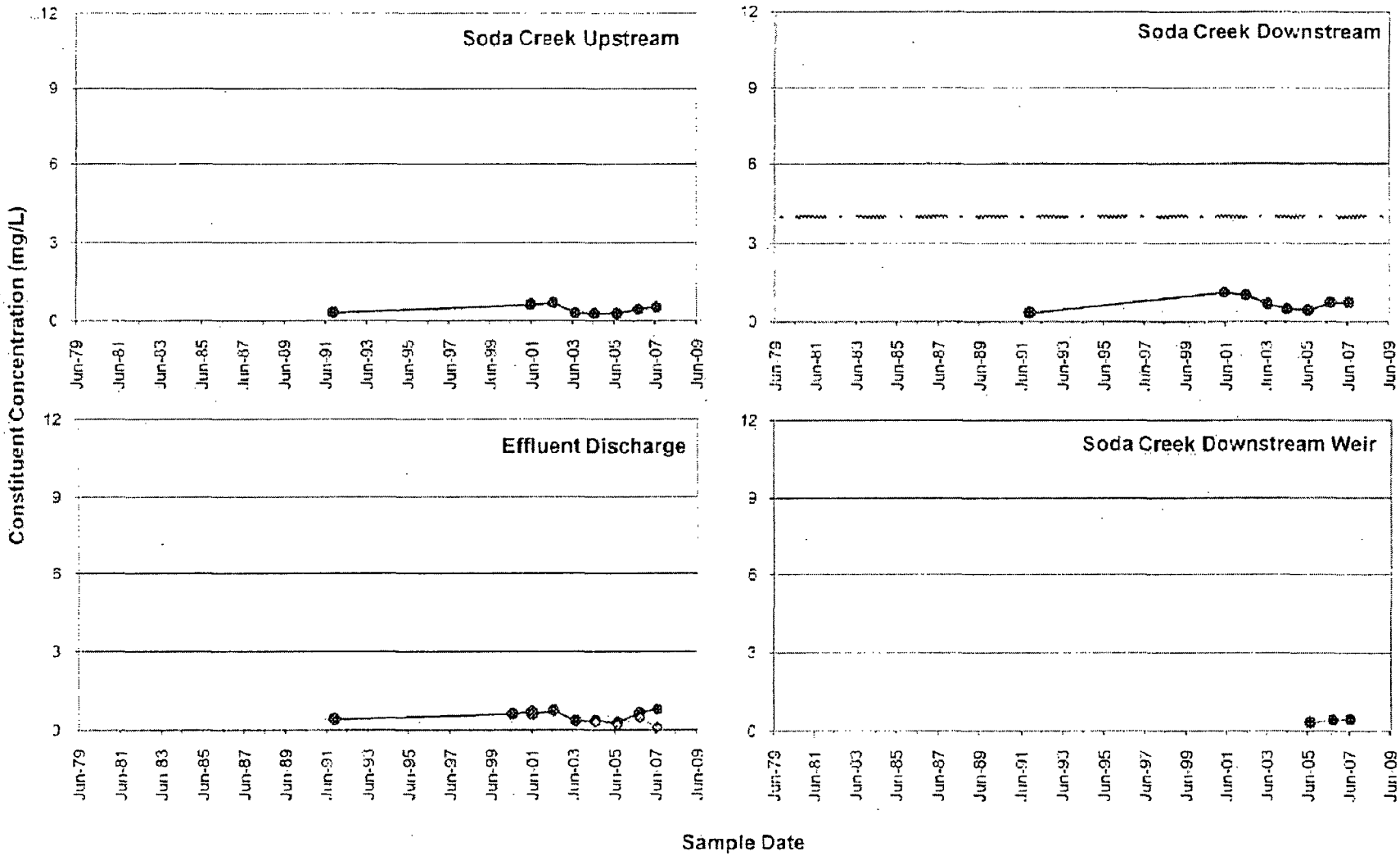
Fluoride in Harris Well and Springs South of Plant

FIGURE B-4

Constituent Concentration (mg/L)

Fluoride Remediation Goal (4 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



Remediation goals shown for point of compliance locations only

FILE NAME App B Fluoride Charts 2007.xls

Golder Associates

TITLE

Fluoride in Soda Creek and Treatment Plant Effluent

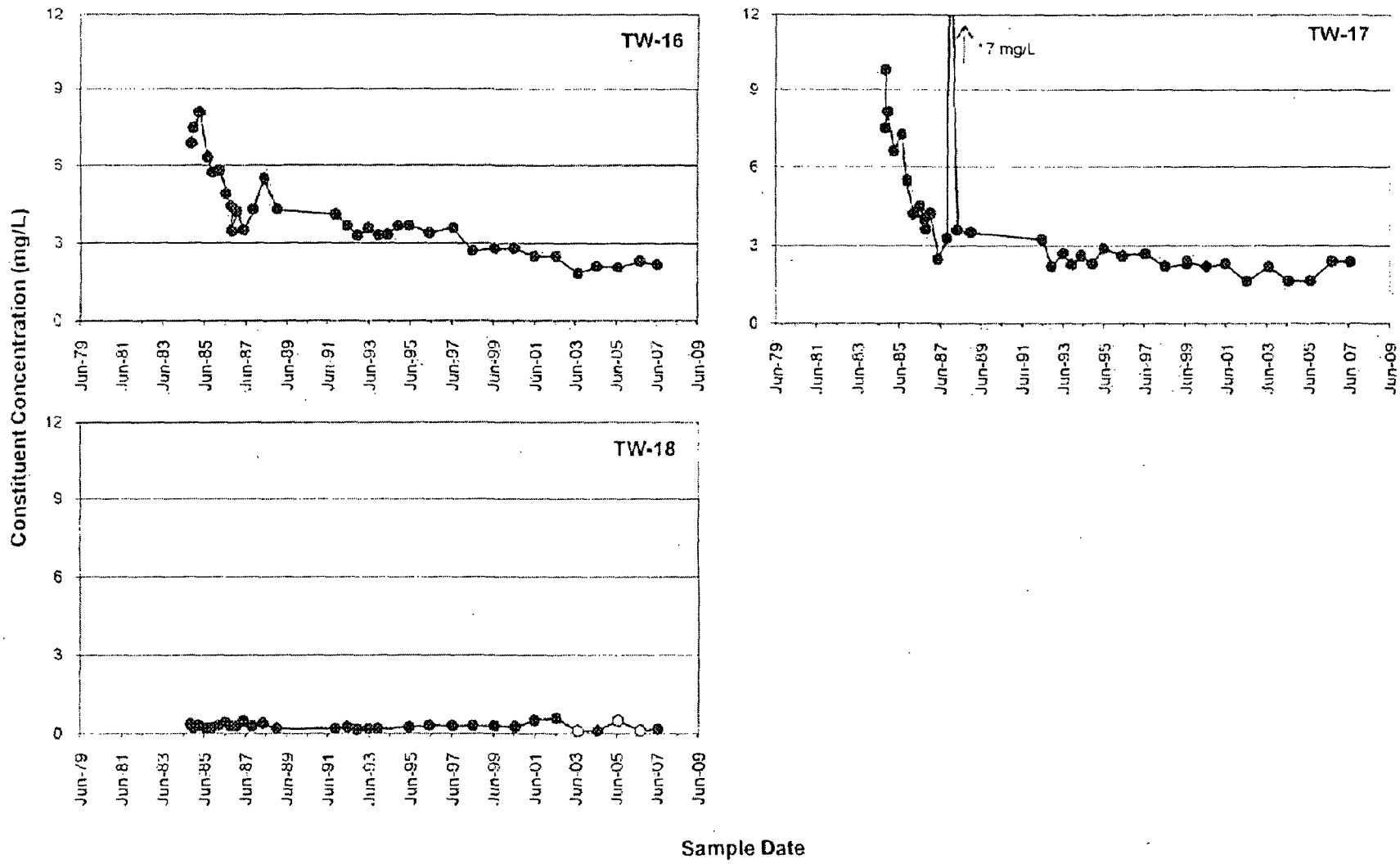
FIGURE B-5

Constituent Concentration (mg/L)

Fluoride Remediation Goal (4 mg/L)

Pond Inlet

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

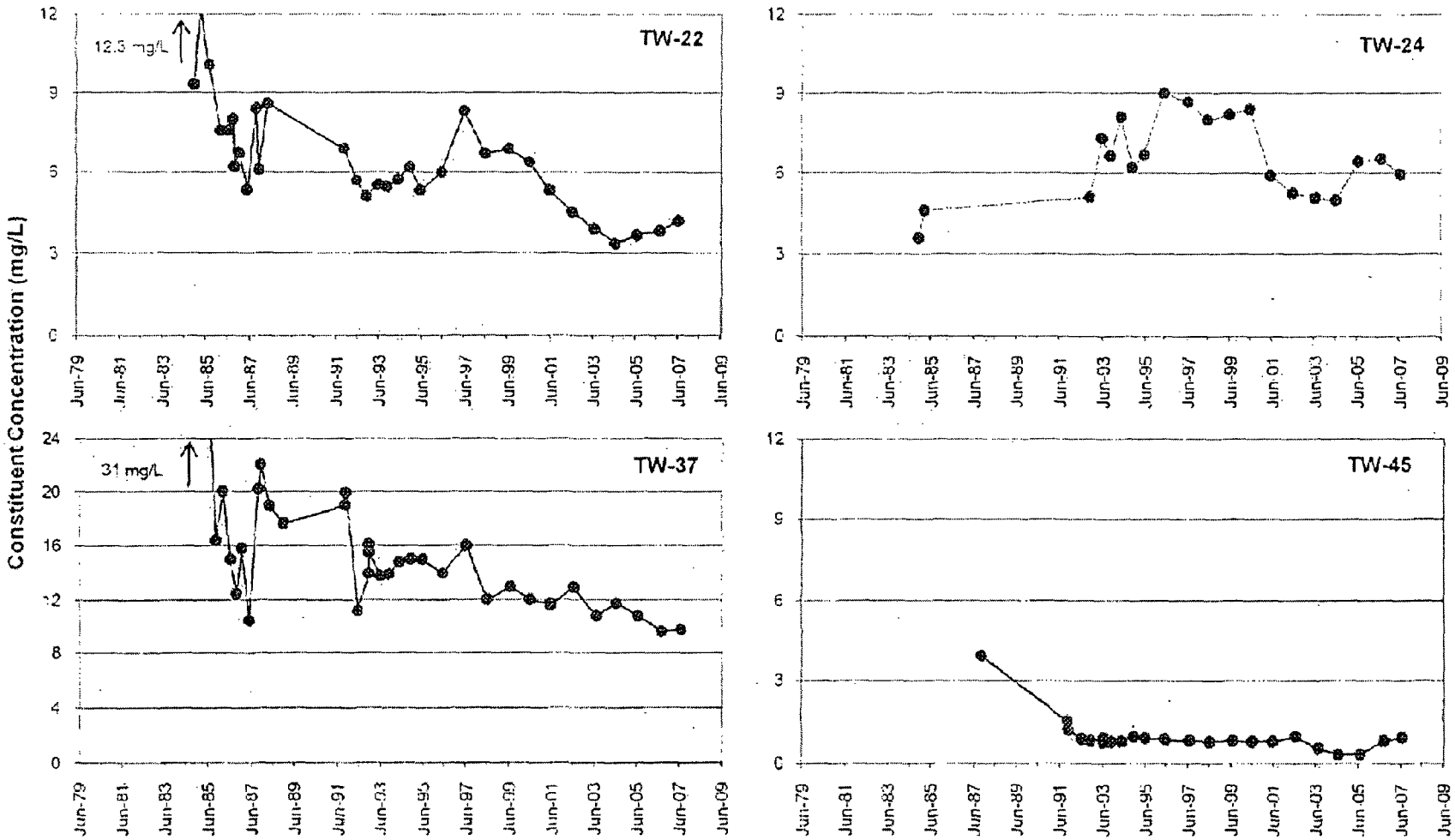
TITLE **Fluoride in NW Pond Wells**

FIGURE **B-6**

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101 605A	DATE 29-Nov-07	REVIEWED CB



Remediation goals shown for point of compliance locations only

FILE NAME App B Fluoride Charts 2007.xls

Golder Associates

TITLE

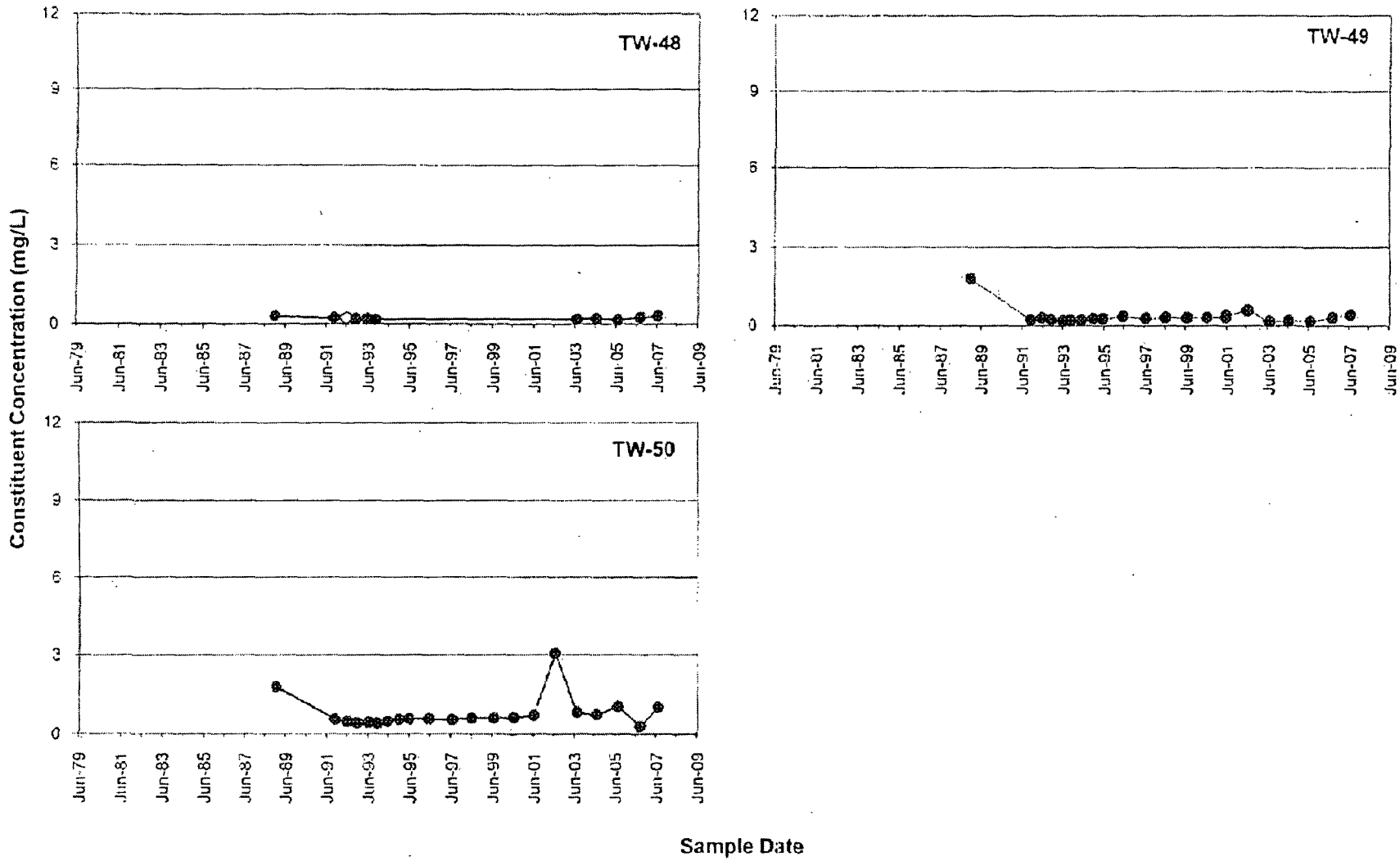
Fluoride in Old Underflow Solids Pond Area Wells

FIGURE B-7

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME Apc B Fluoride Charts 2007 xls

Remediation goals shown for point of compliance locations only

Golder Associates

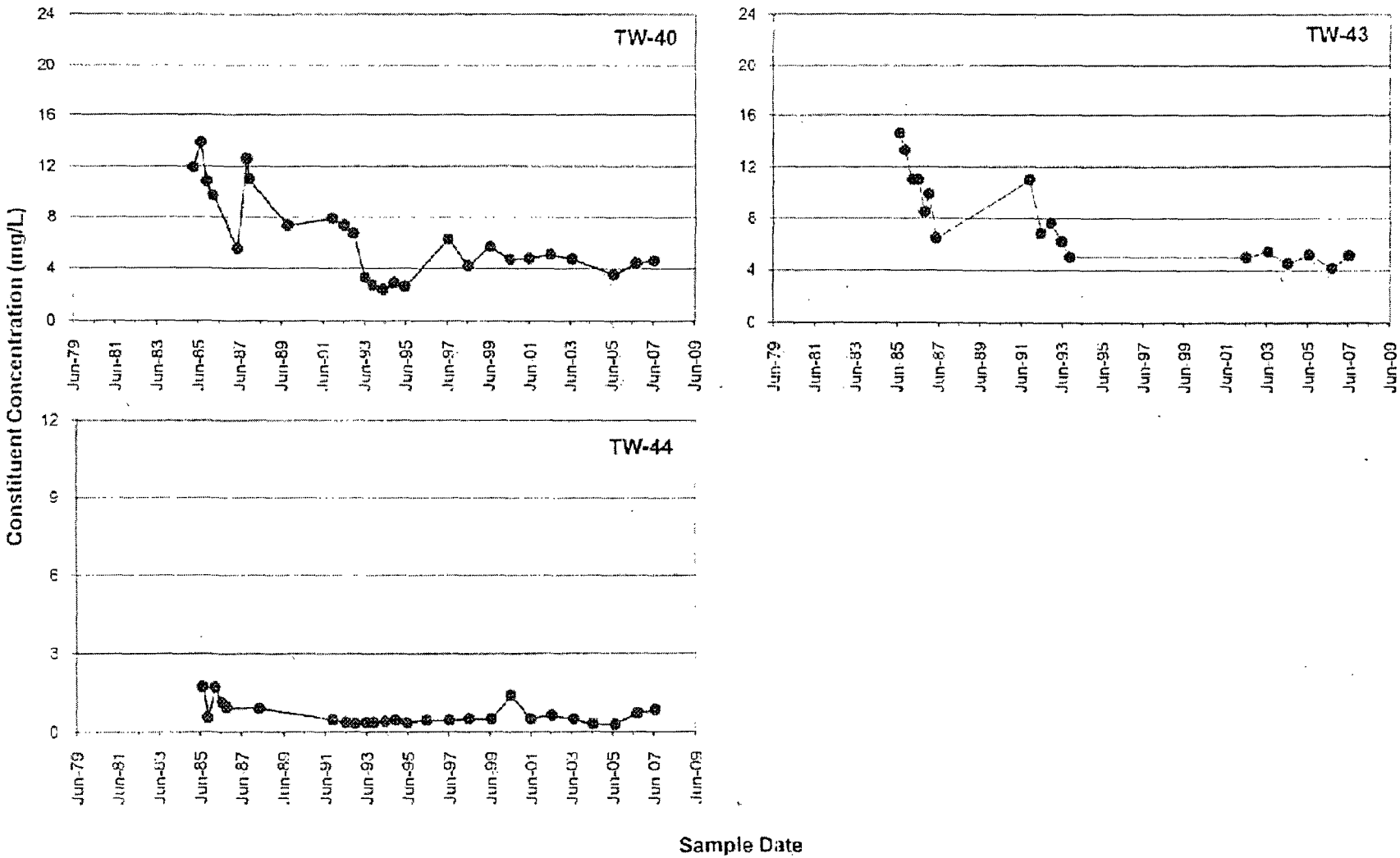
TITLE **Fluoride in Underflow Solids Piles Area Wells**

FIGURE **B-8**

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101 335A	DATE 29-Nov-07	REVIEWED CB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

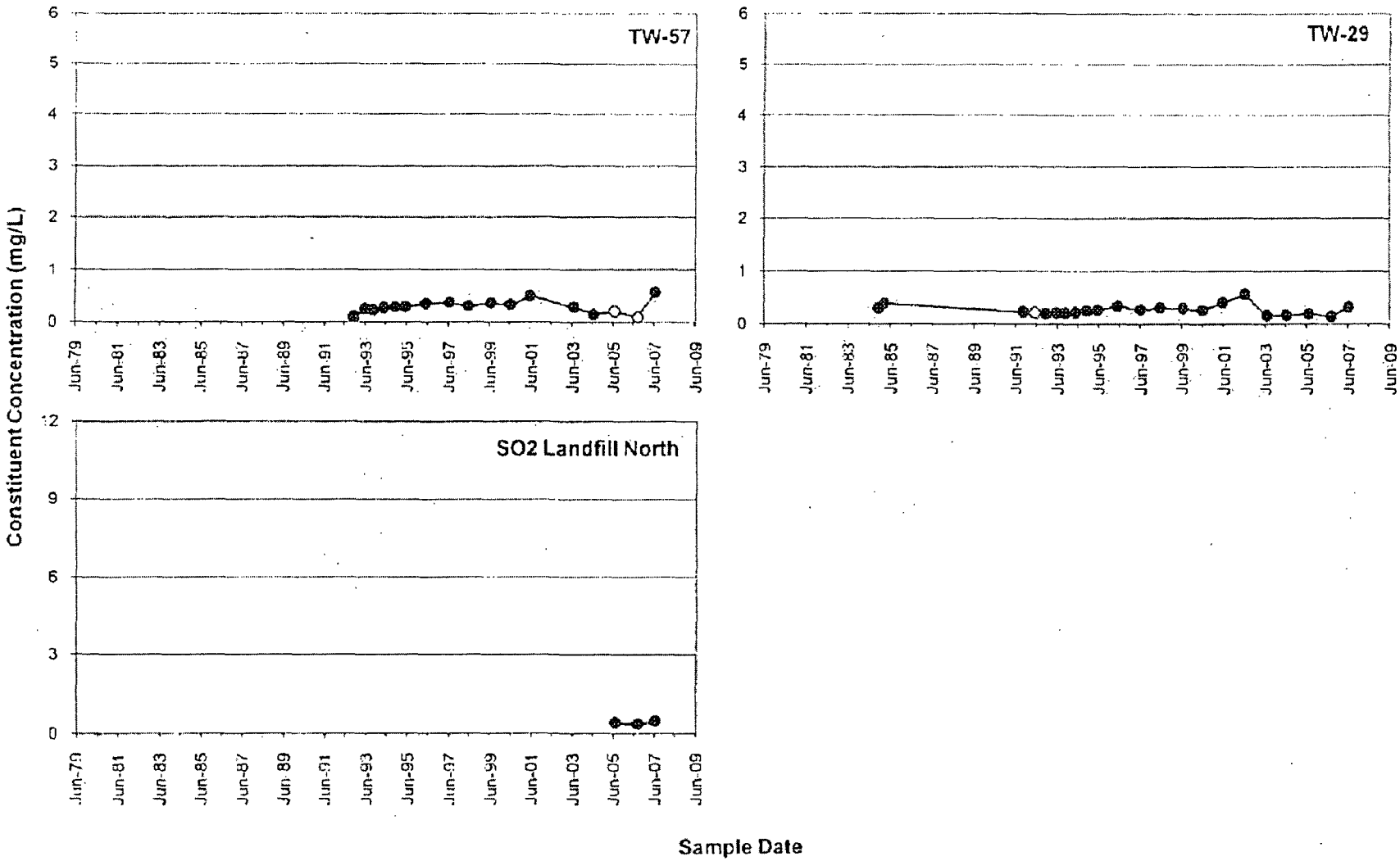
Golder Associates

TITLE **Fluoride in Hydroclarifier Area Wells**

FIGURE B-9

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

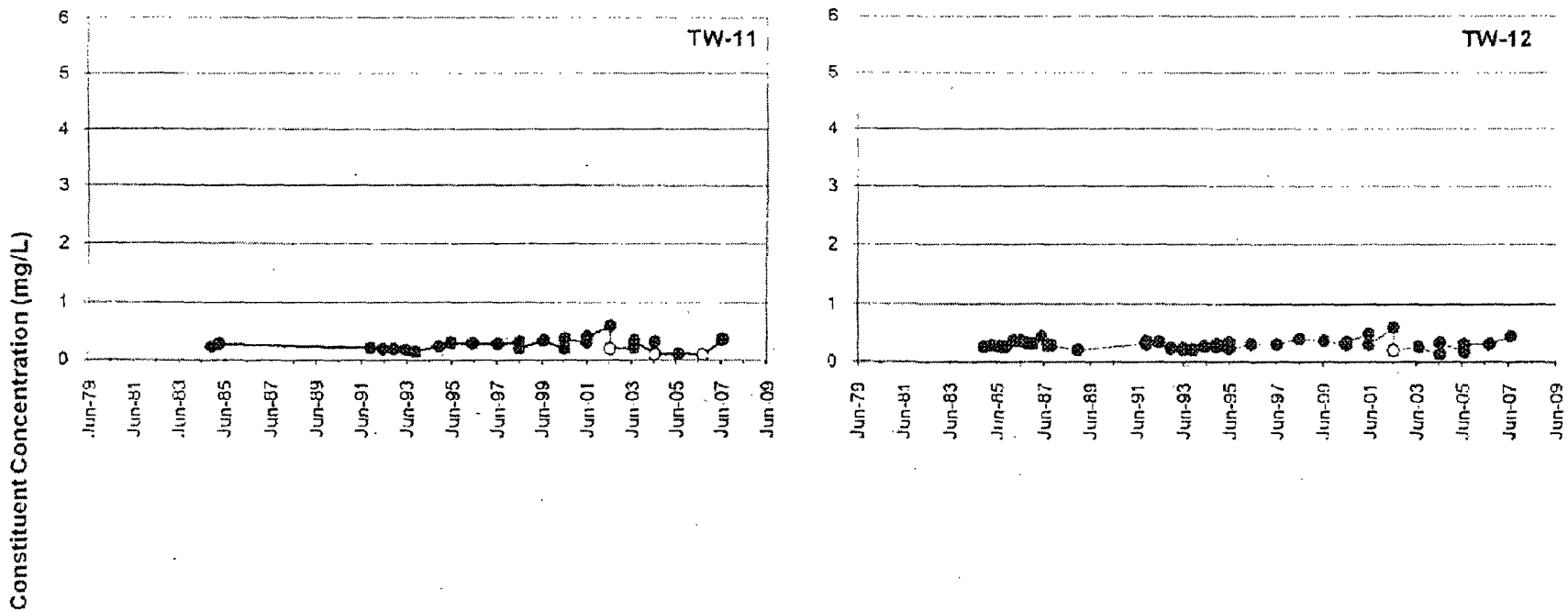
TITLE **Fluoride in Background Area Wells**

FIGURE **B-10**

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101 605A	DATE 29-Nov-07	REVIEWED DB



Sample Date

FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

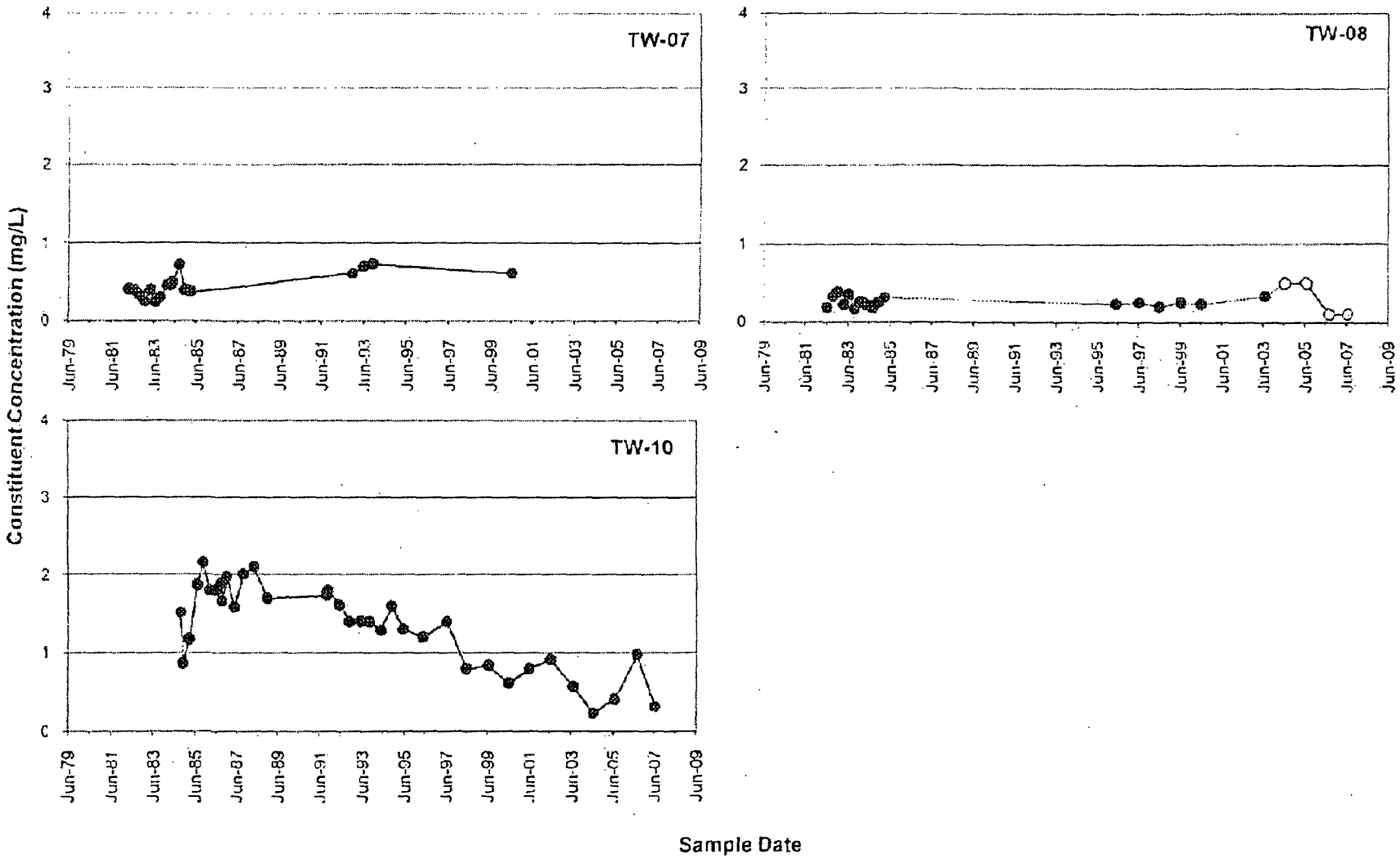
TITLE: Fluoride in Southeast Corner Wells

FIGURE B-11

Constituent Concentration (mg/L)

c Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101 6054	DATE 29-Nov-07	REVIEWED DB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

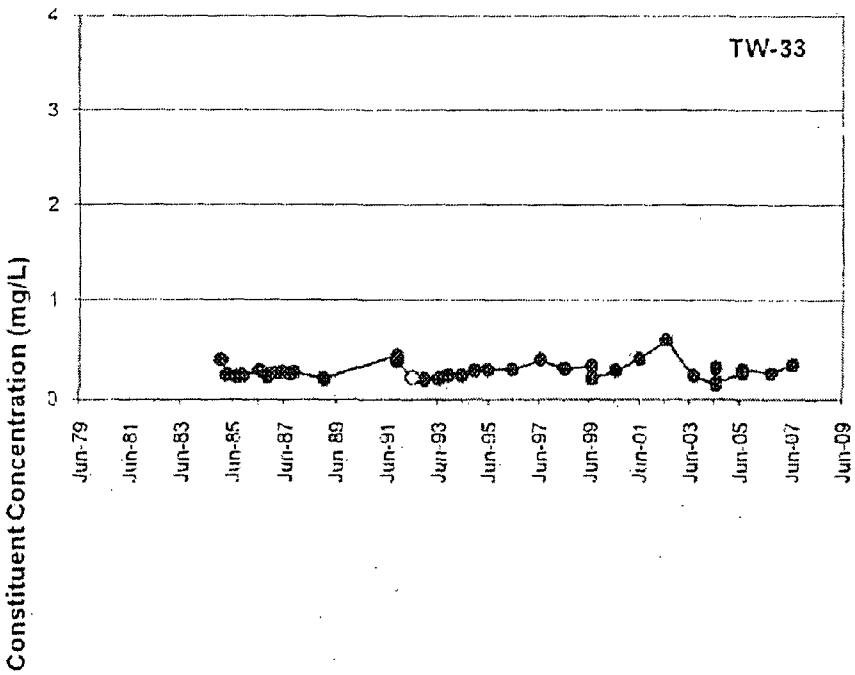
Fluoride in Southwest Corner Wells

FIGURE B-12

Constituent Concentration (mg/L)

o Non-detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



Sample Date

FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Fluoride in East Area Wells**

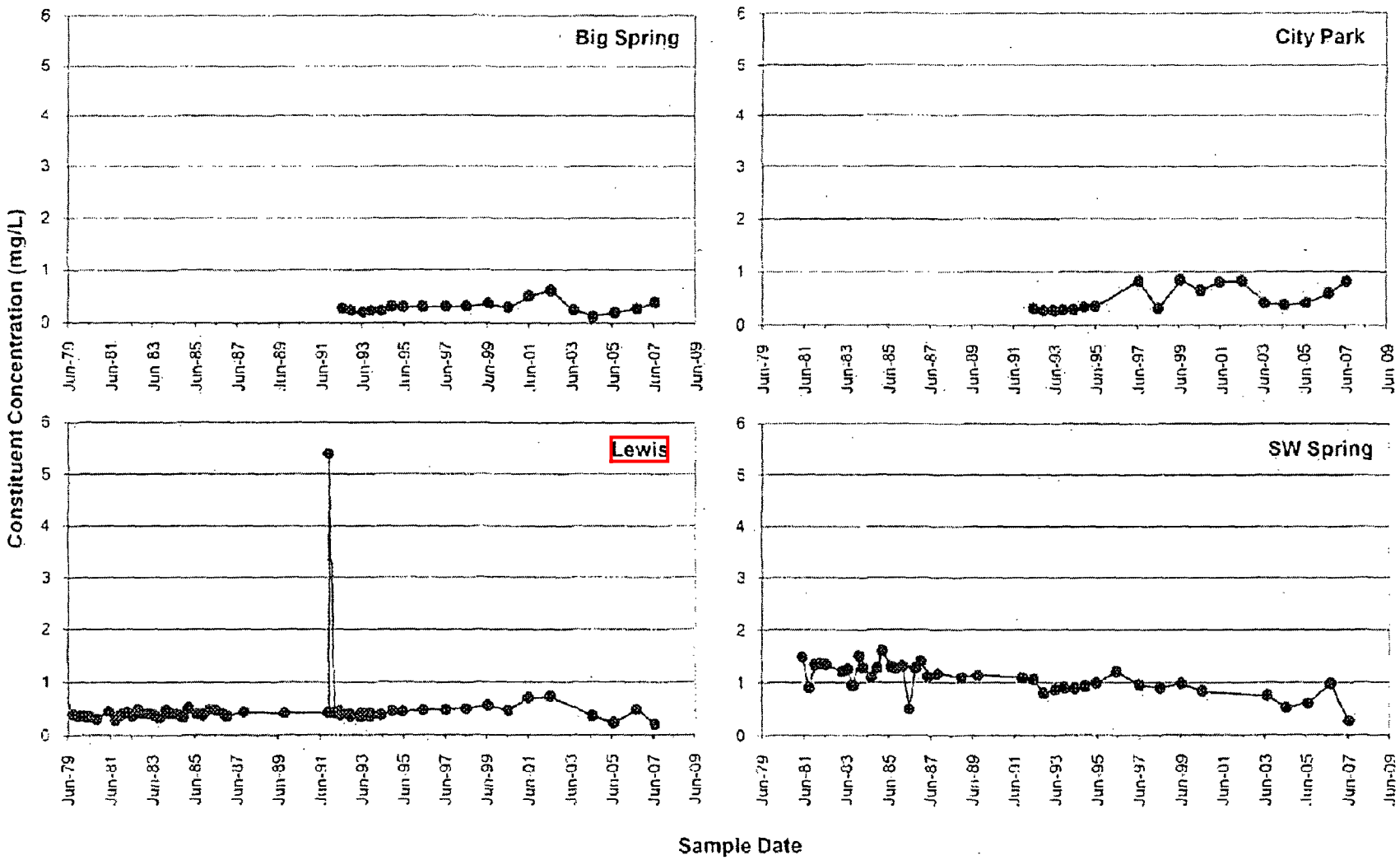
—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company		
PROJECT	Monsanto Groundwater Monitoring		
PROJECT NO	913-1101,605A	DATE 29-Nov-07	

FIGURE B-13

DRAWN	DH
CHECKED	MPK
REVIEWED	DB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

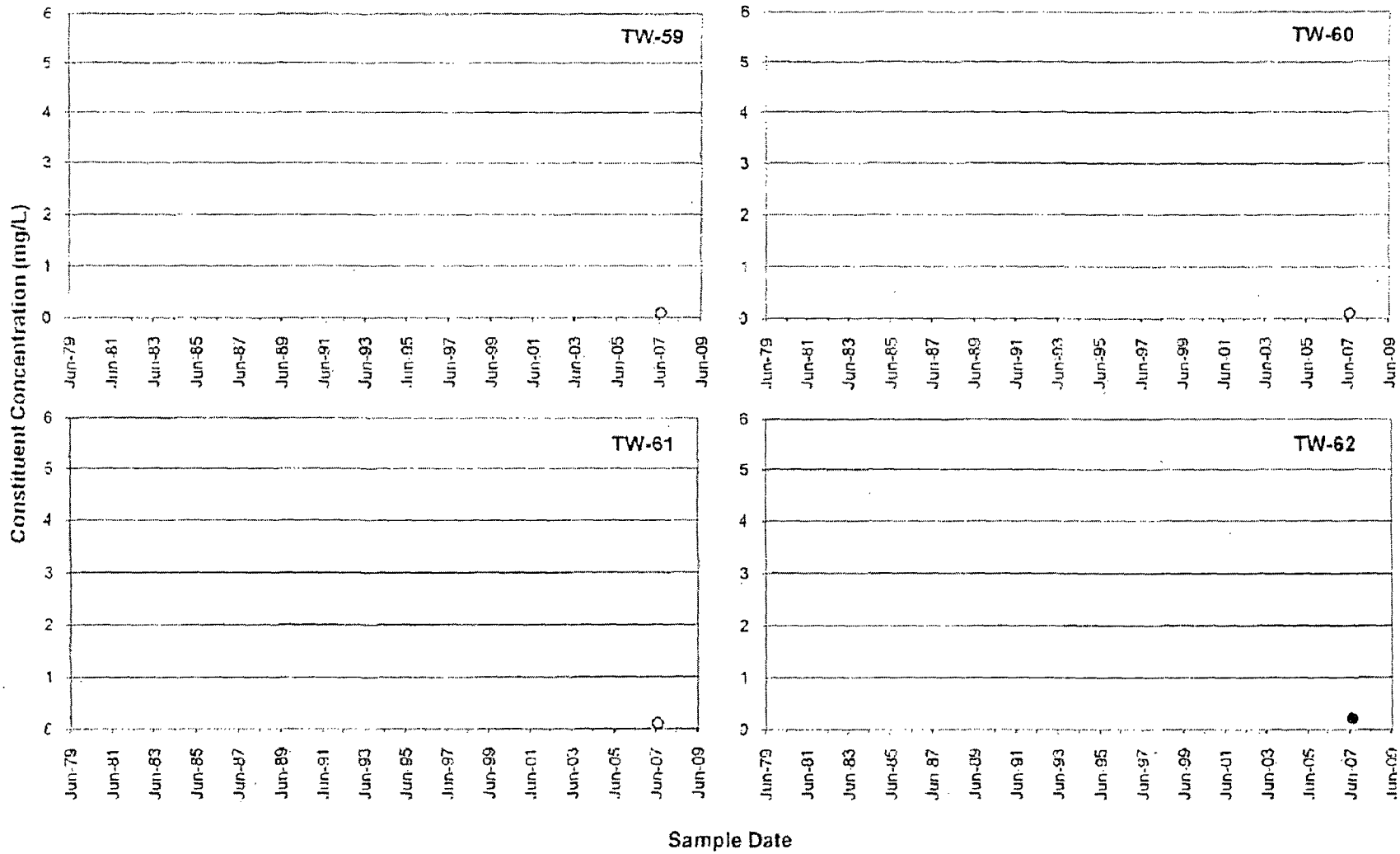
Fluoride in Offsite Wells and Springs

FIGURE B-14

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	CH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.6054	DATE 29-Nov-07	REVIEWED DB



FILE NAME App B Fluoride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Fluoride in 2007 Monitoring Wells**

FIGURE **B-15**

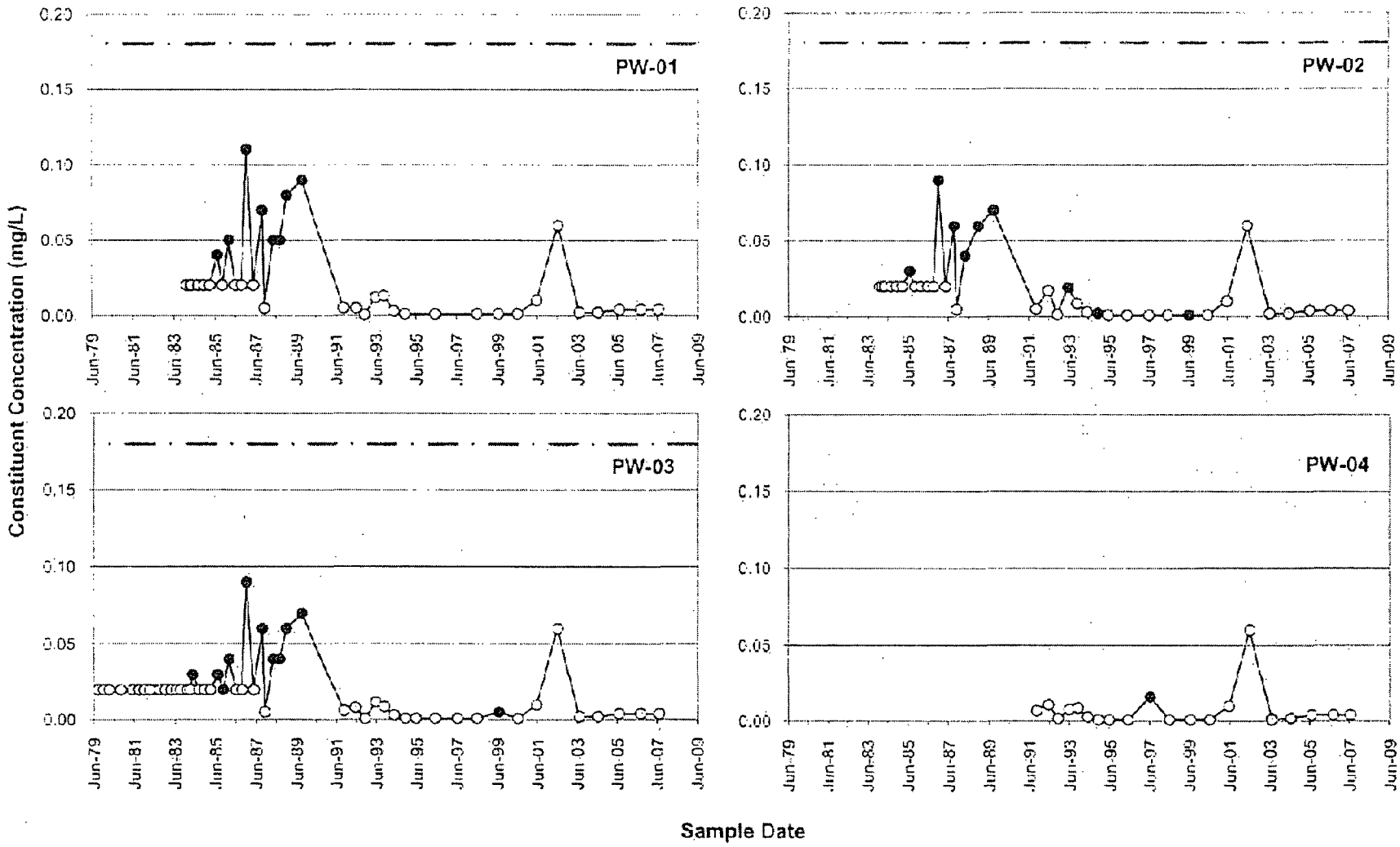
—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB

APPENDIX C

TIME-HISTORY GRAPHS FOR MANGANESE



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

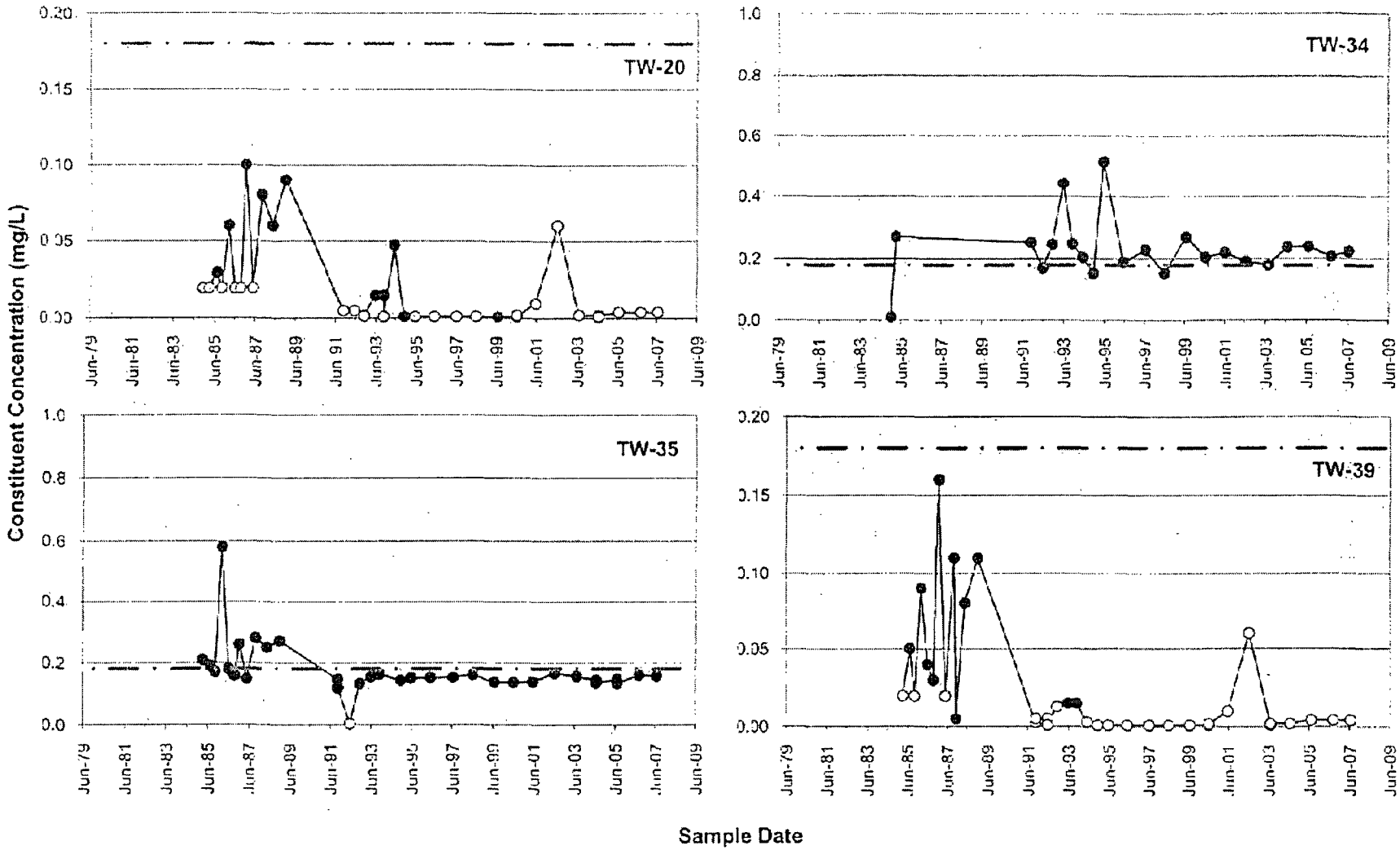
Golder Associates

TITLE **Manganese in Production Wells**

FIGURE C-1

—●— Constituent Concentration (mg/L)
○ Non-Detects
— · — Manganese Remediation Goal (0.18 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

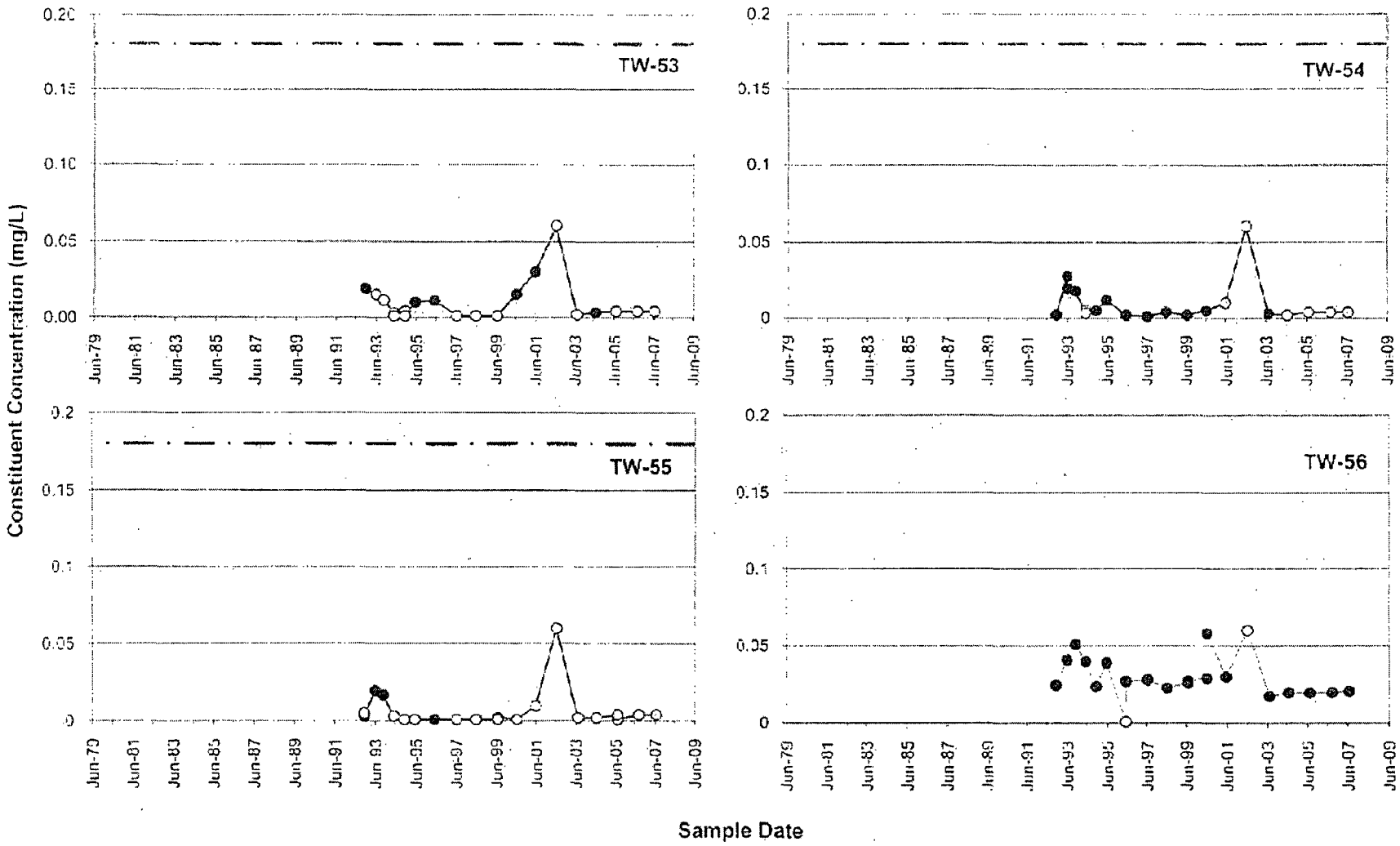
Golder Associates

TITLE **Manganese in South Fenceline Wells**

FIGURE C-2

Constituent Concentration (mg/L)
Non-Detects
Manganese Remediation Goal (0.18 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101 505A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

Manganese in Southern Boundary Wells

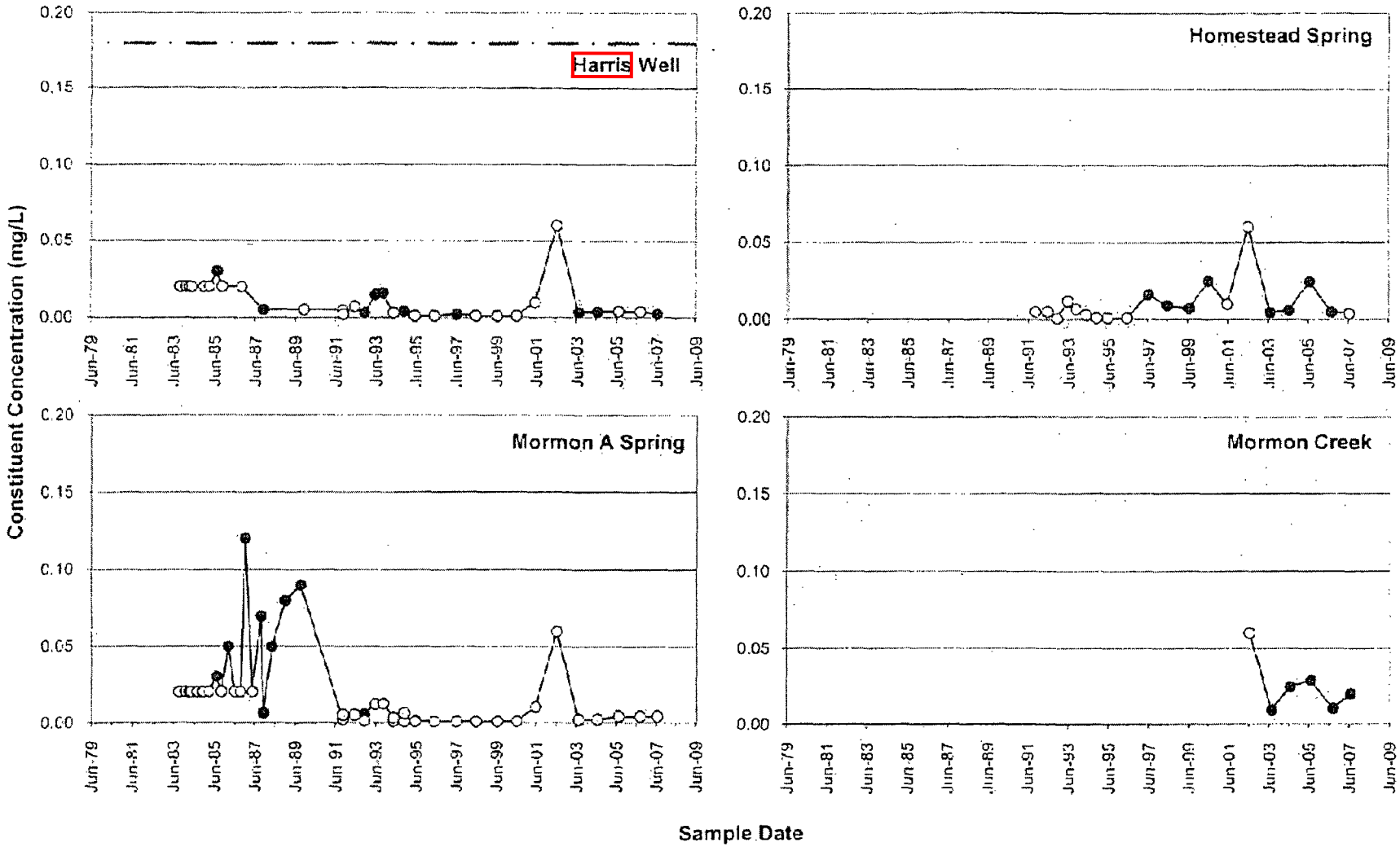
FIGURE C-3

—●— Constituent Concentration (mg/L)

○ Non-Detects

— · — Manganese Remediation Goal (0.18 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	CB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

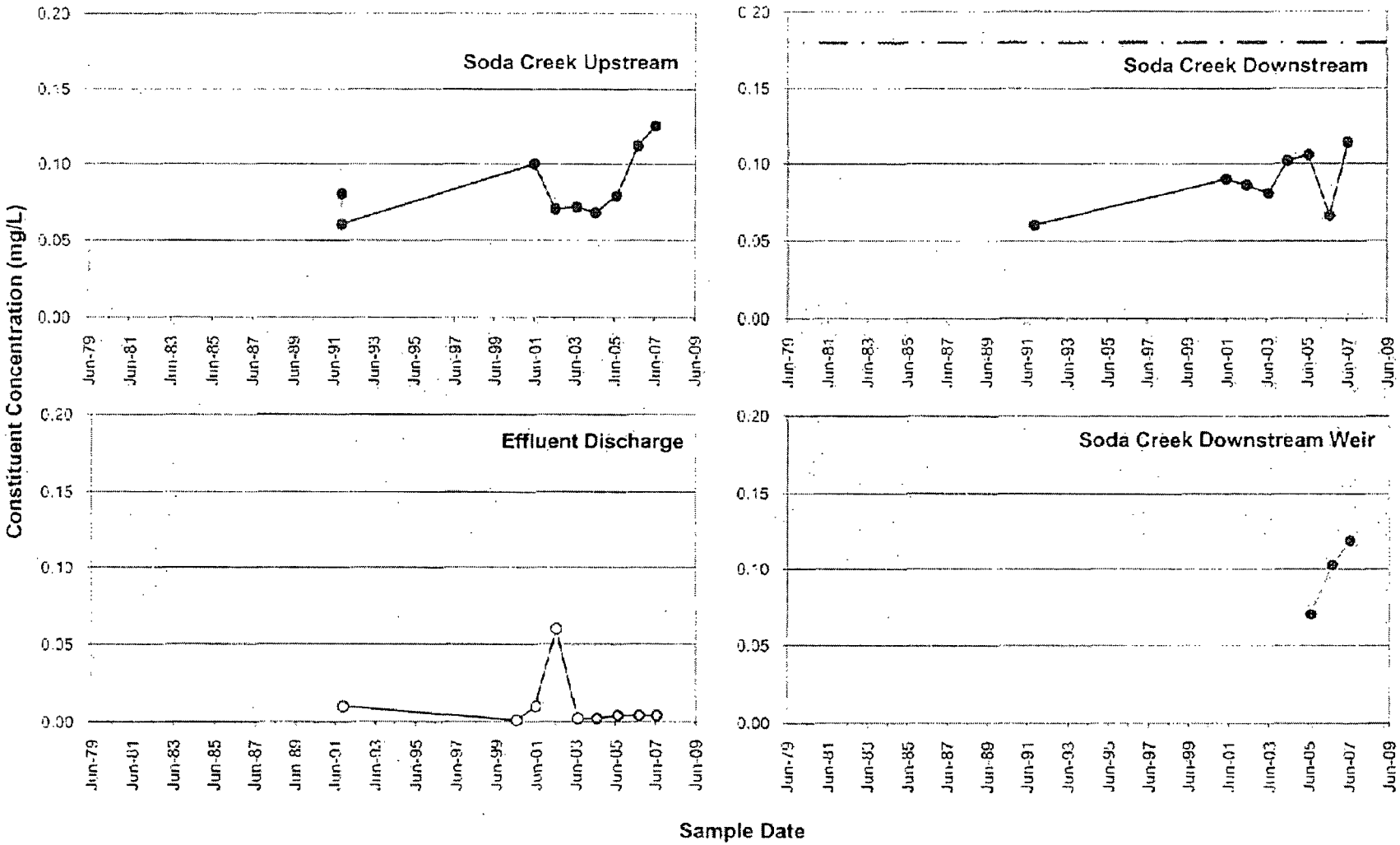
Golder Associates

TITLE **Manganese in Harris Well and Springs South of Plant**

FIGURE C-4

Constituent Concentration (mg/L)
Non-Detects
Manganese Remediation Goal (0.18 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



FILE NAME App C Manganese Charts 2007 xls

Remediation goals shown for point of compliance locations only

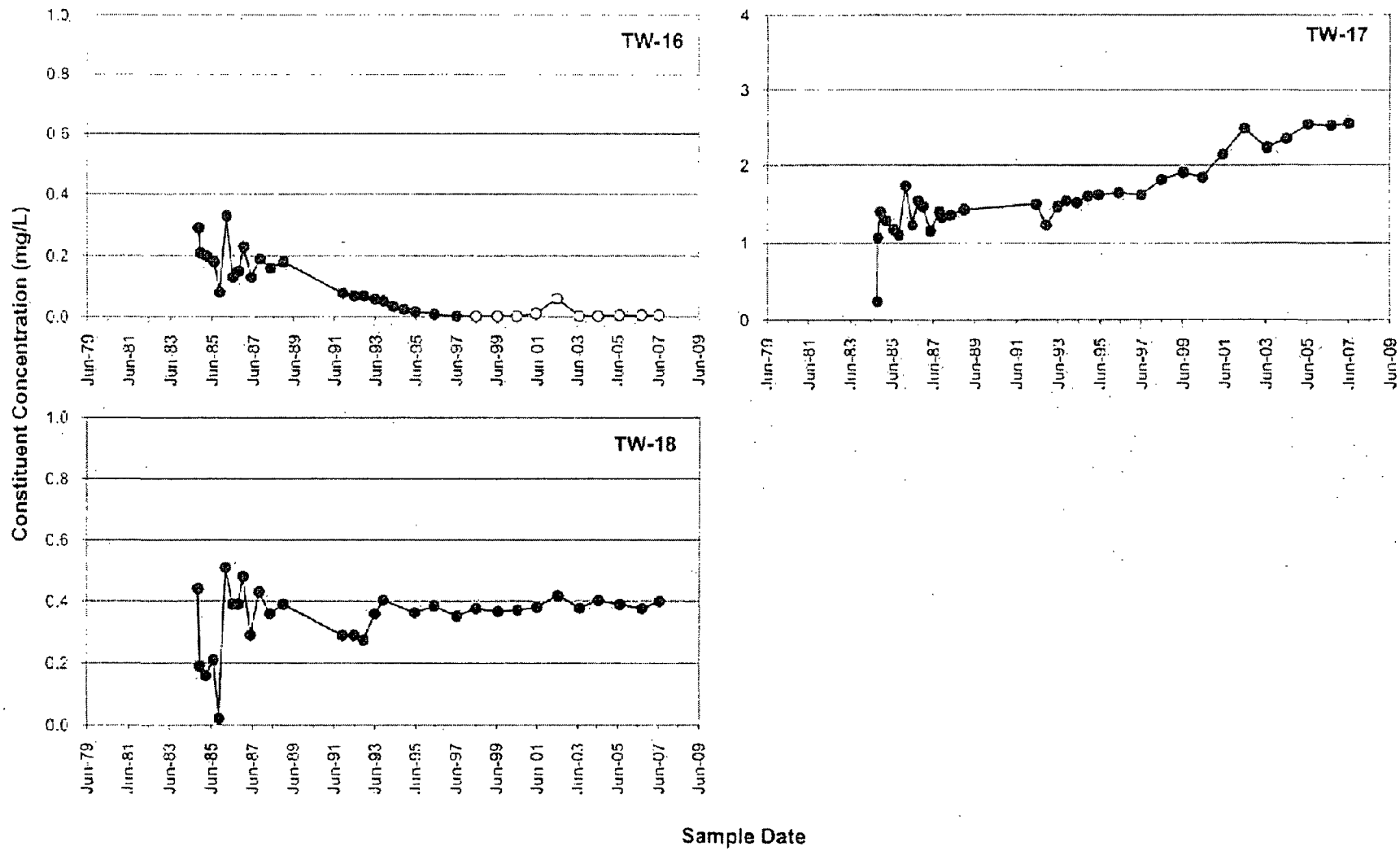
Golder Associates

TITLE **Manganese in Soda Creek and Treatment Plant Effluent**

FIGURE C-5

Constituent Concentration (mg/L)
Non-detect
Fluoride Remediation Goal (4 mg/L)
Pond inlet (non-detects)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

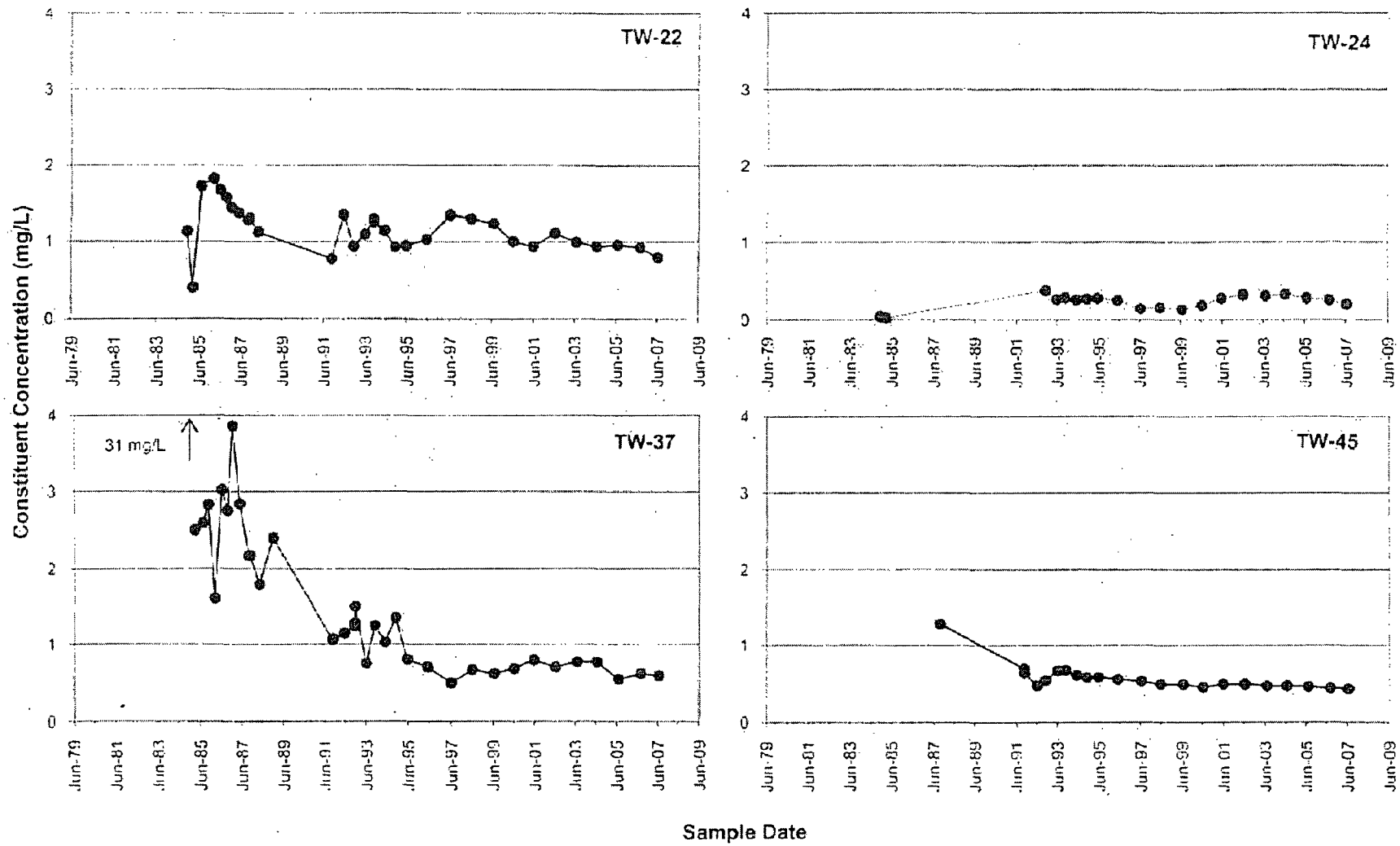
TITLE **Manganese in NW Pond Wells**

FIGURE C-6

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MFK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007 x s

Remediation goals shown for point of compliance locations only

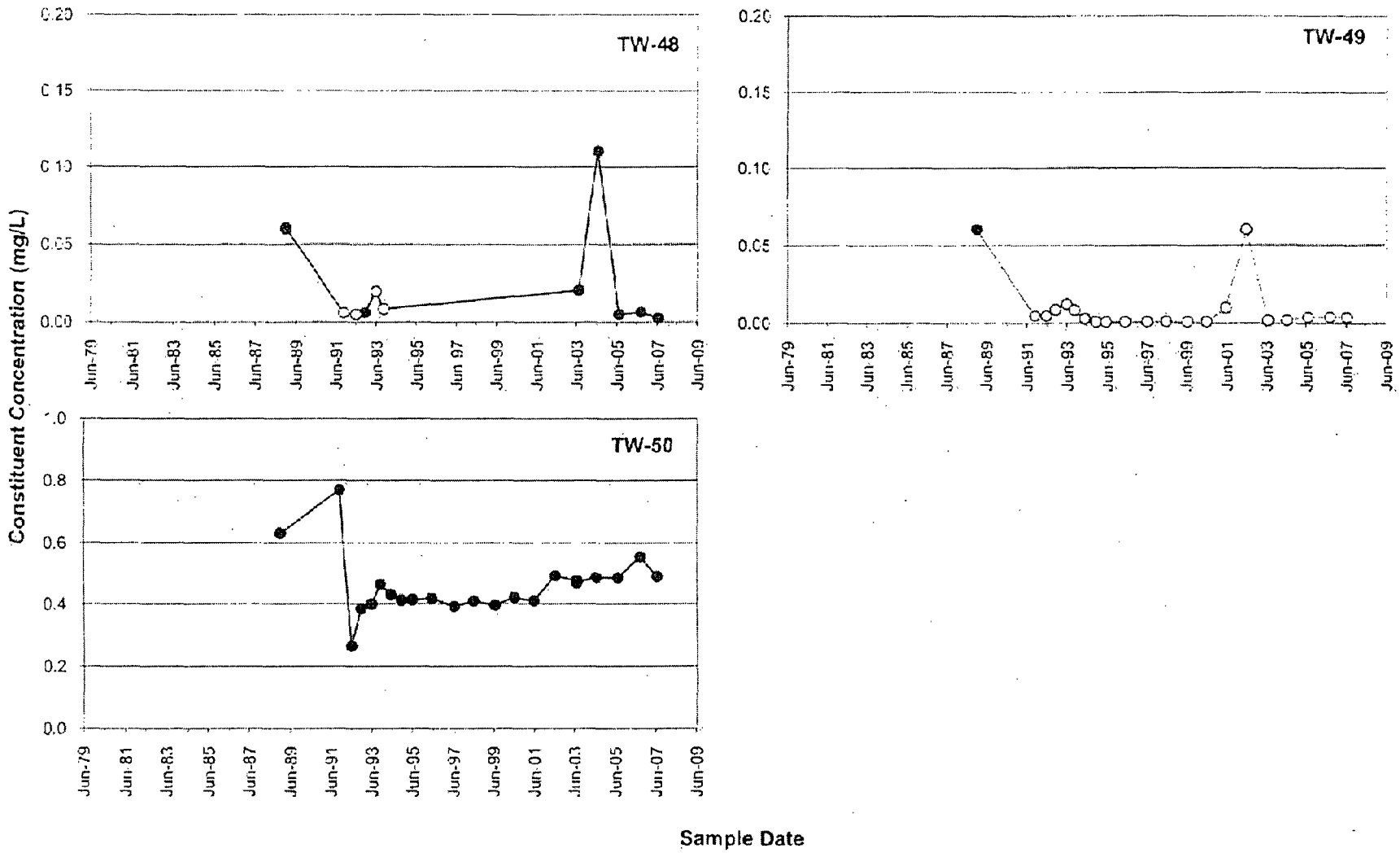
Golder Associates

TITLE **Manganese in Old Underflow Solids Pond Area Wells**

FIGURE C-7

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Mangsnese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

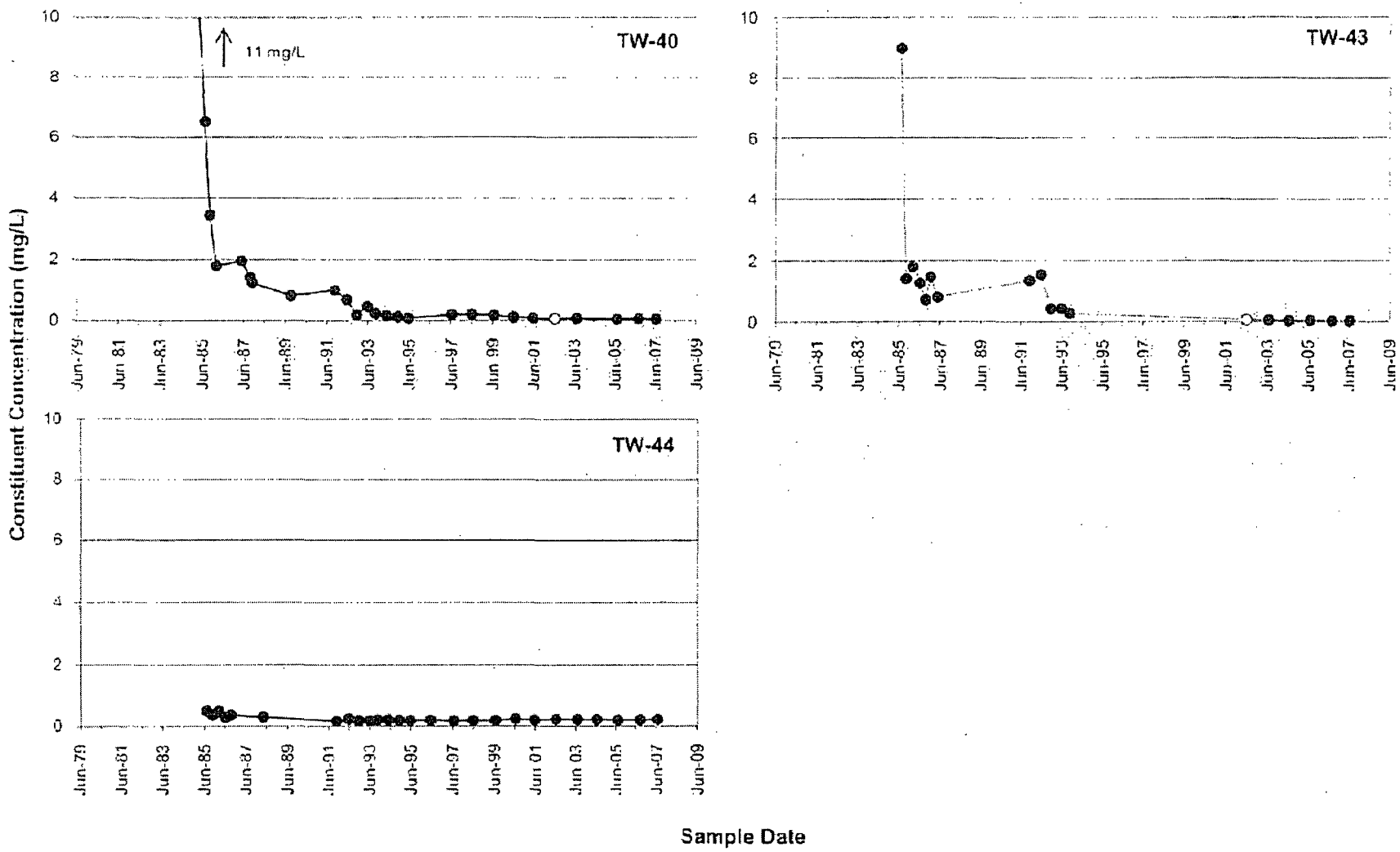
TITLE **Manganese in Underflow Solids Piles Area Wells**

FIGURE C-8

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

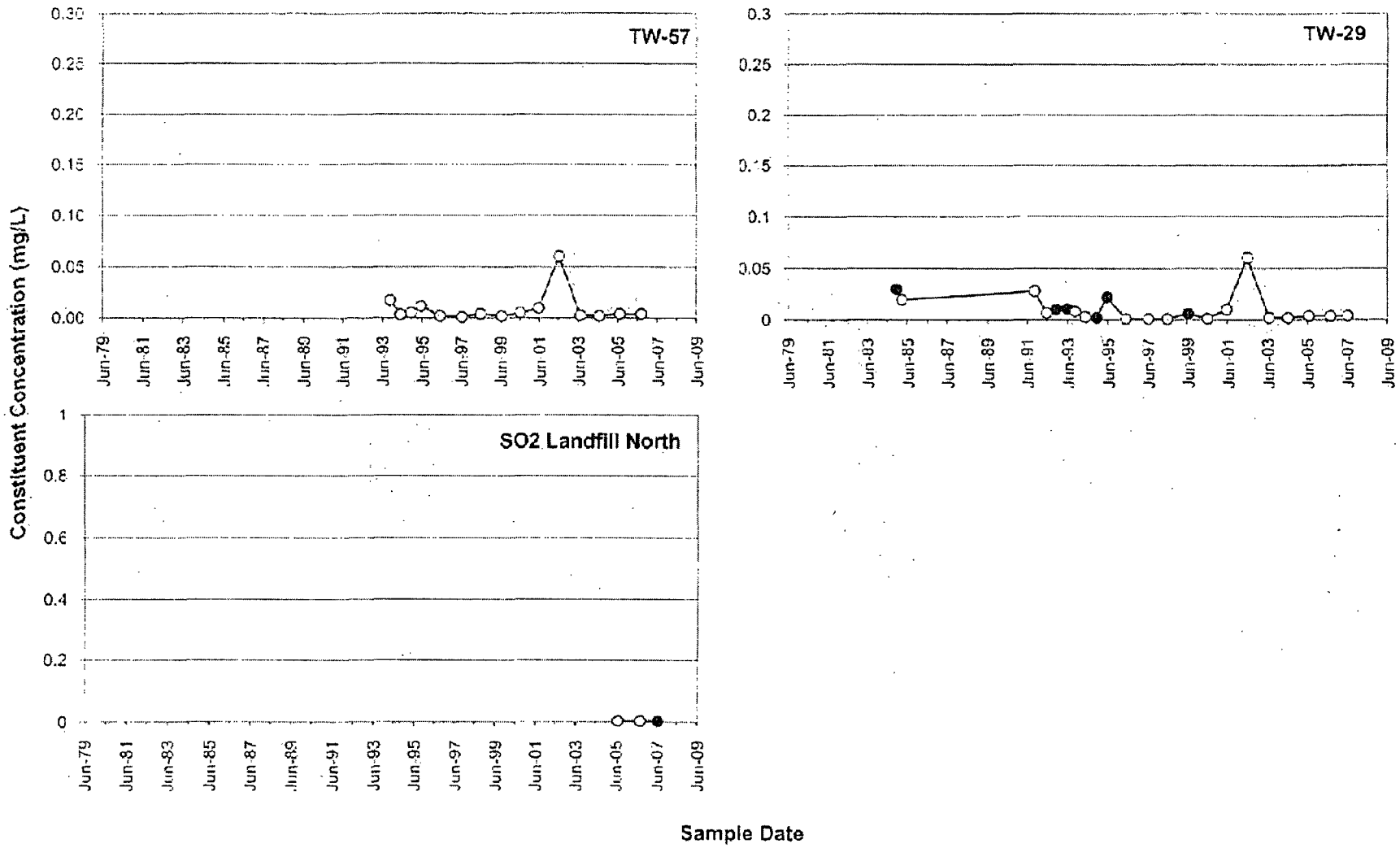
Manganese in Hydroclarifier Area Wells

FIGURE C-9

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

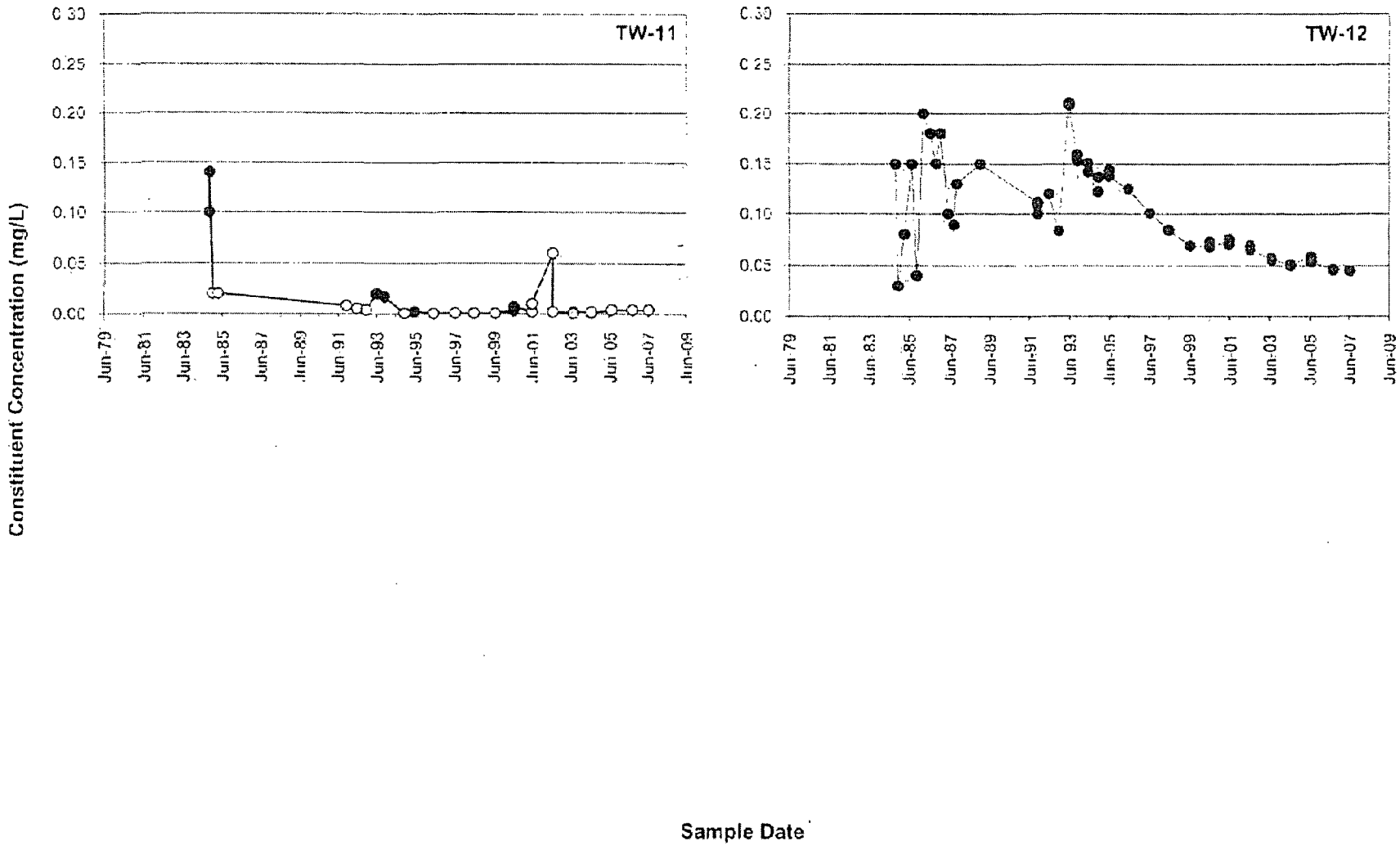
Manganese in Background Area Wells

FIGURE C-10

—●— Constituent Concentration (mg/L)

○ Non-detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Manganese in Southeast Corner Wells**

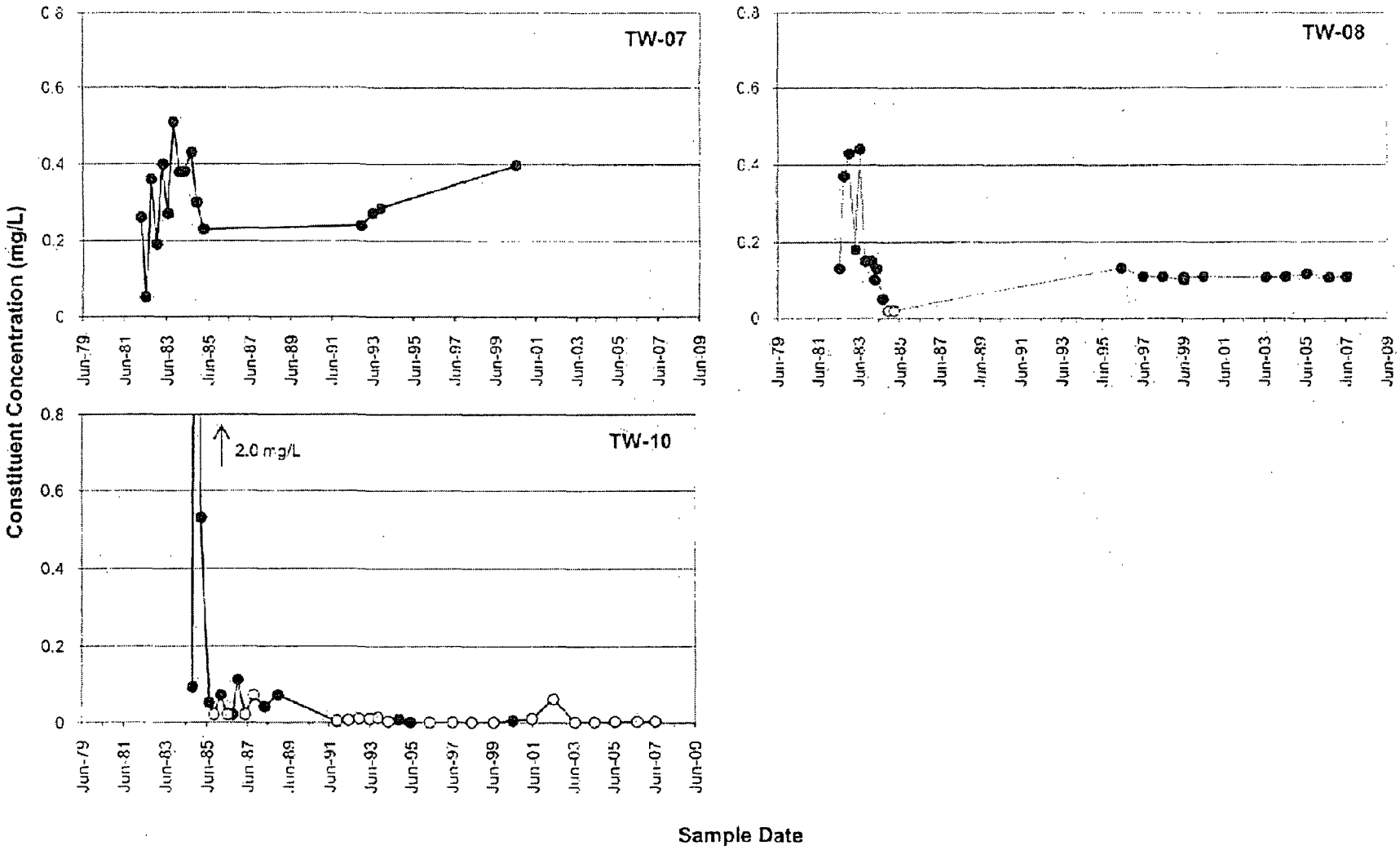
FIGURE C-11

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company		
PROJECT	Monsanto Groundwater Monitoring		
PROJECT NO	913-1101.605A	DATE 29-Nov-07	

DRAWN	DH
CHECKED	MPK
REVIEWED	DB



Remediation goals shown for point of compliance locations only

FILE NAME App C Manganese Charts 2007.xls

Golder Associates

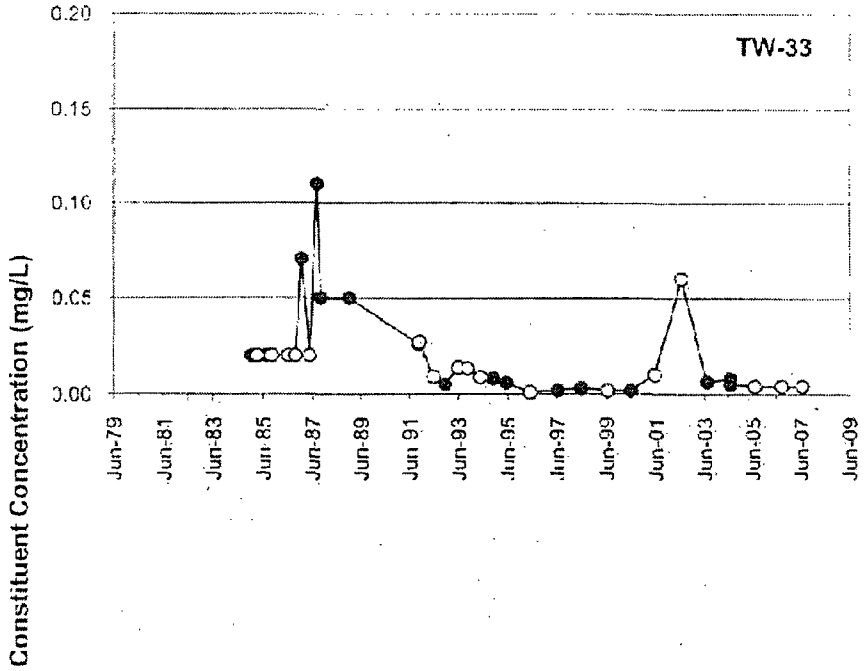
TITLE **Manganese in Southwest Corner Wells**

FIGURE C-12

—●— Constituent Concentration (mg/L)

○ Non-detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



Sample Date

FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

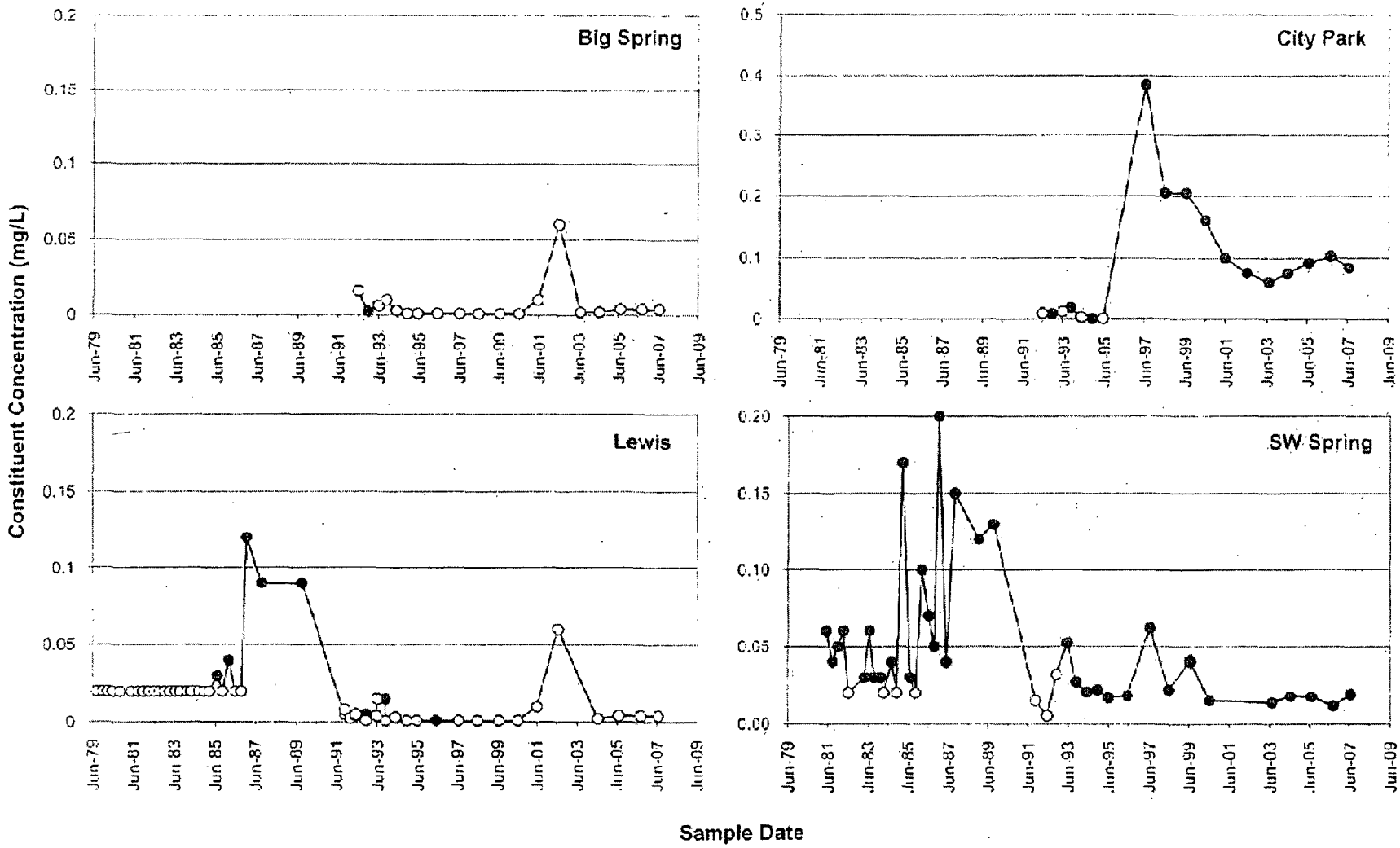
Manganese in East Area Wells

FIGURE C-13

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

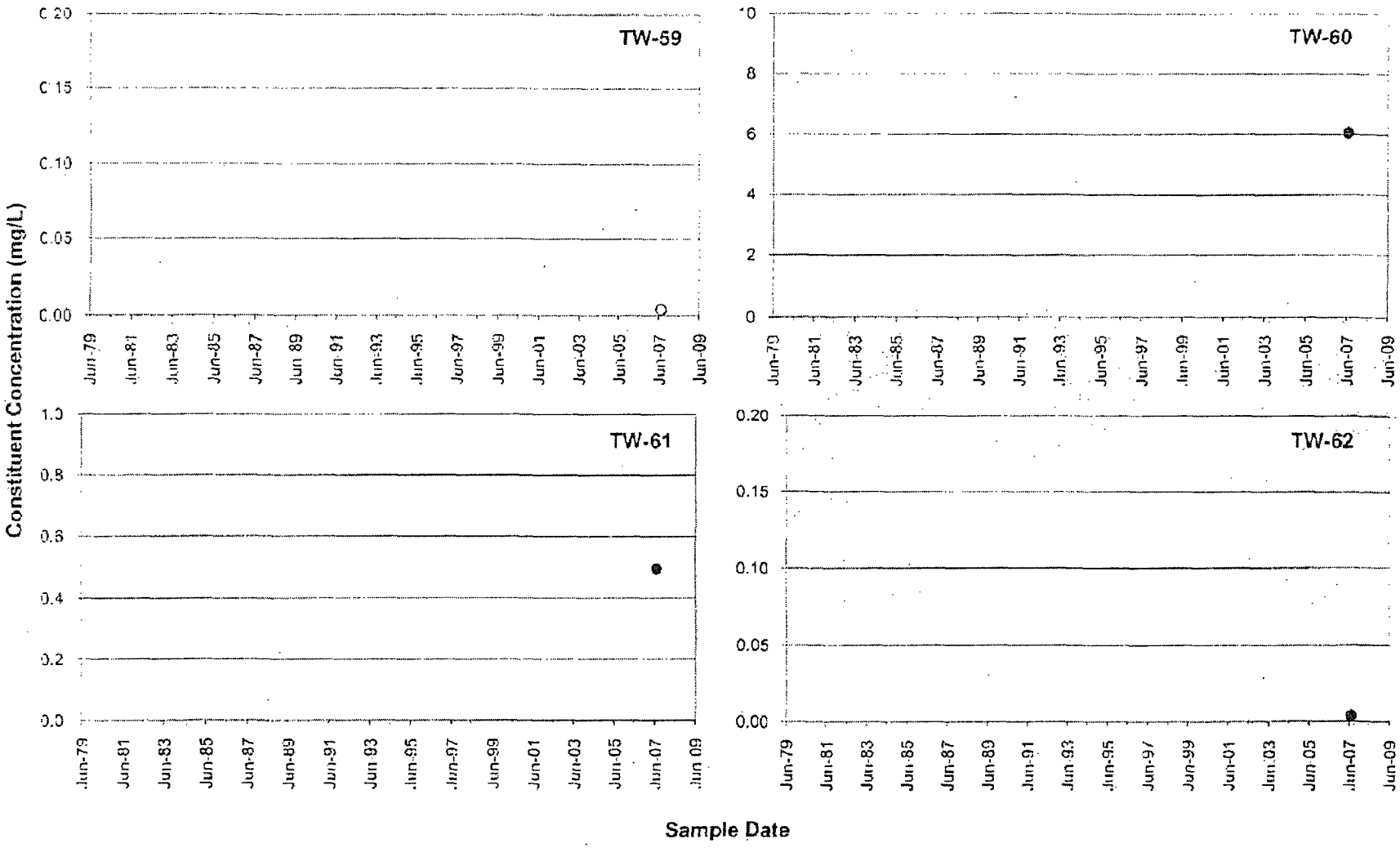
Manganese in Offsite Wells and Springs

FIGURE C-14

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Manganese Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Manganese in 2007 Monitoring Wells**

FIGURE **C-15**

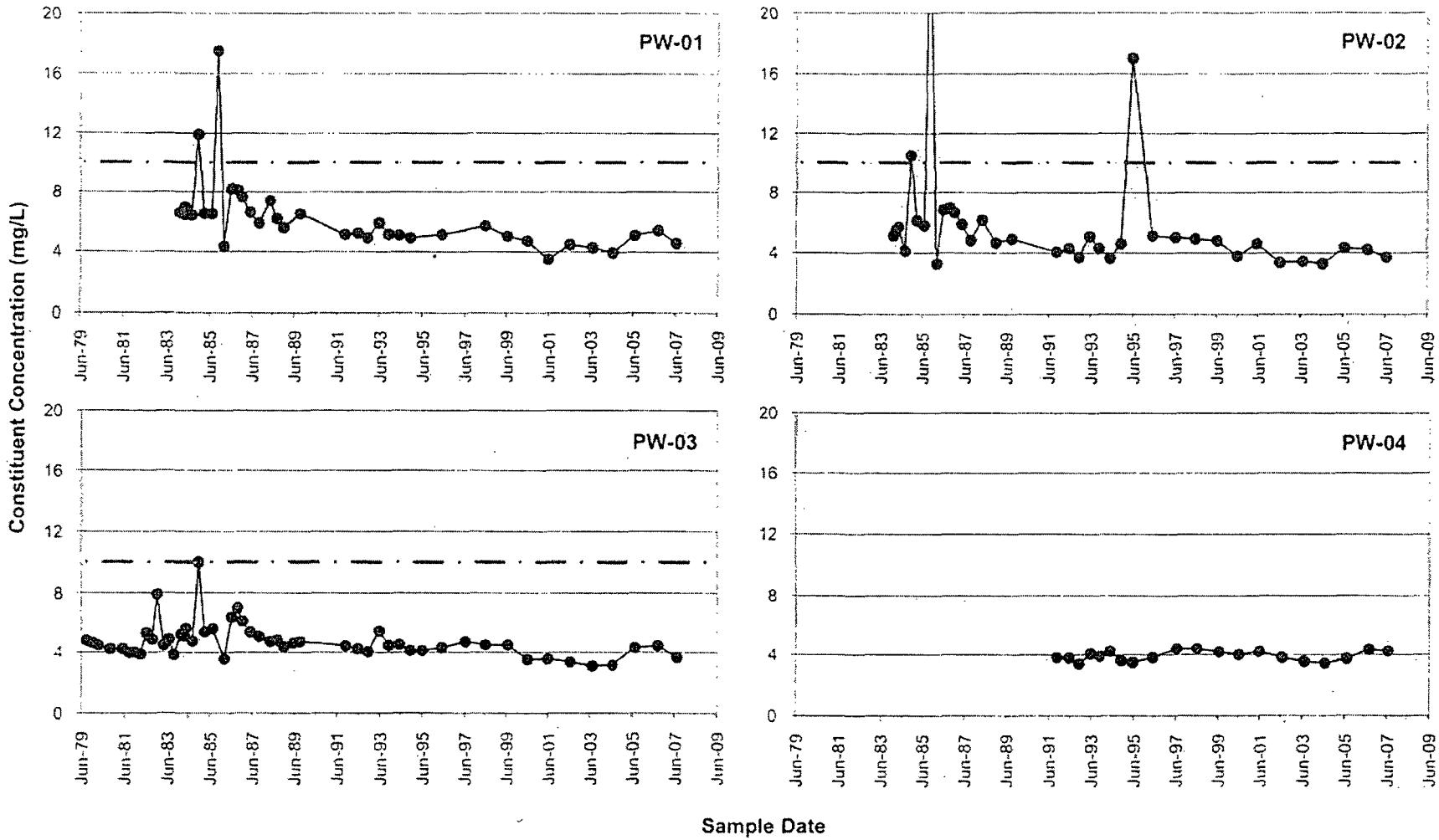
—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	CH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB

APPENDIX D

TIME-HISTORY GRAPHS FOR NITRATE AS N



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

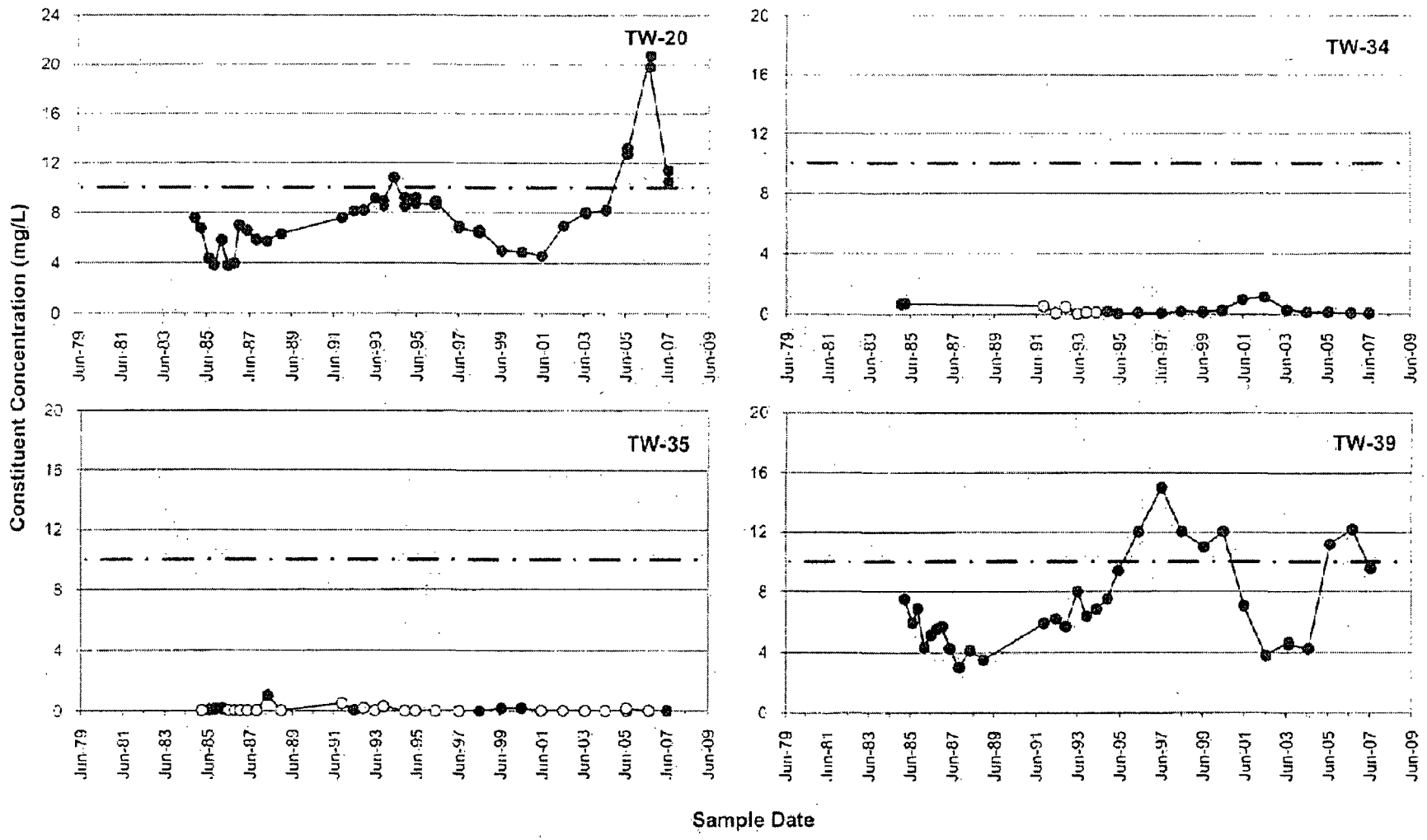
Golder Associates

TITLE **Nitrate in Production Wells**

FIGURE D-1

—●— Constituent Concentration (mg/L)
○ Non-Detects
— · — Nitrate as N Remediation Goal (10 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

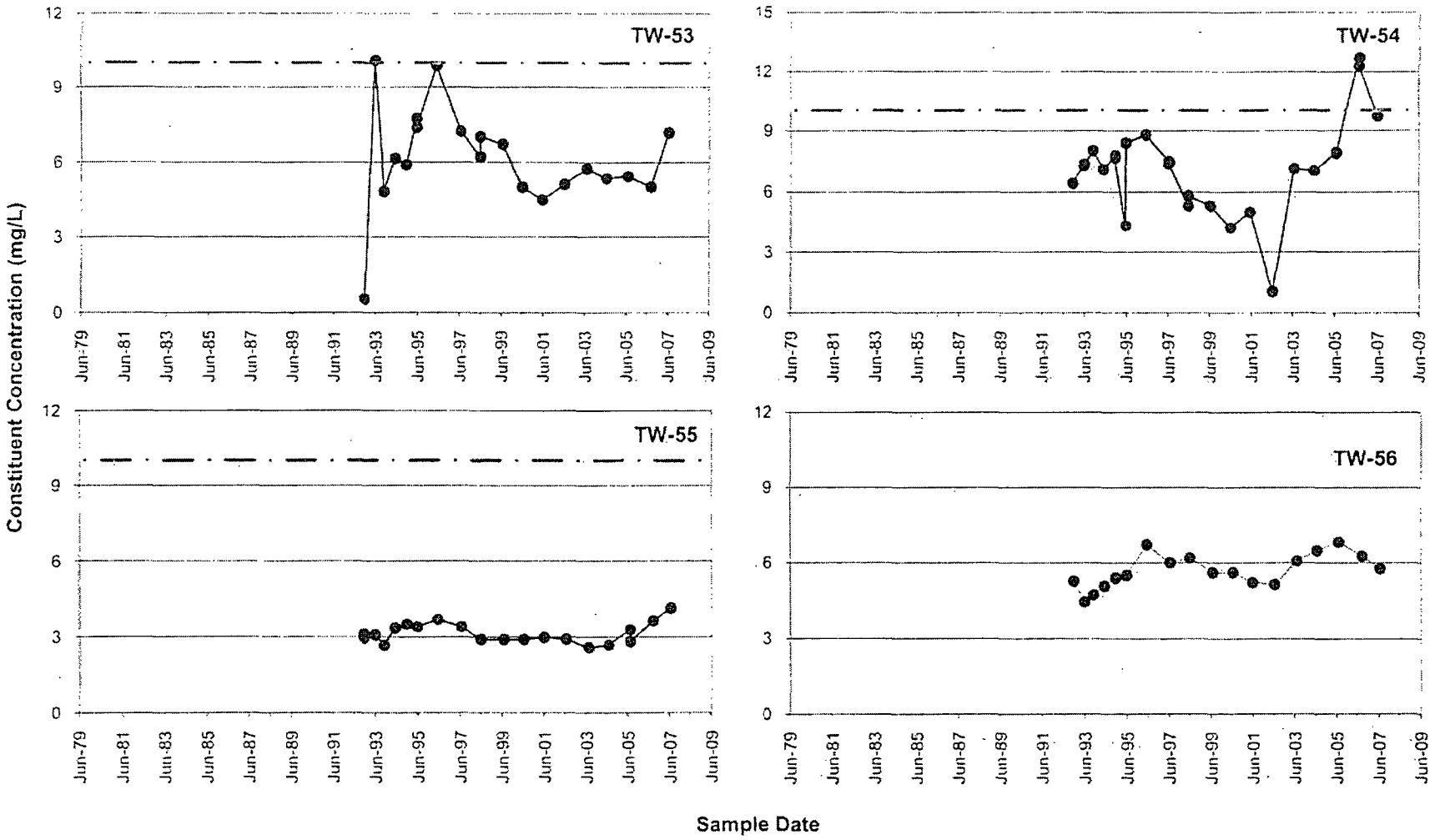
Golder Associates

TITLE **Nitrate in South Fenceline Wells**

FIGURE D-2

Constituent Concentration (mg/L)
Non-Detects
Nitrate as N Remediation Goal (10 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

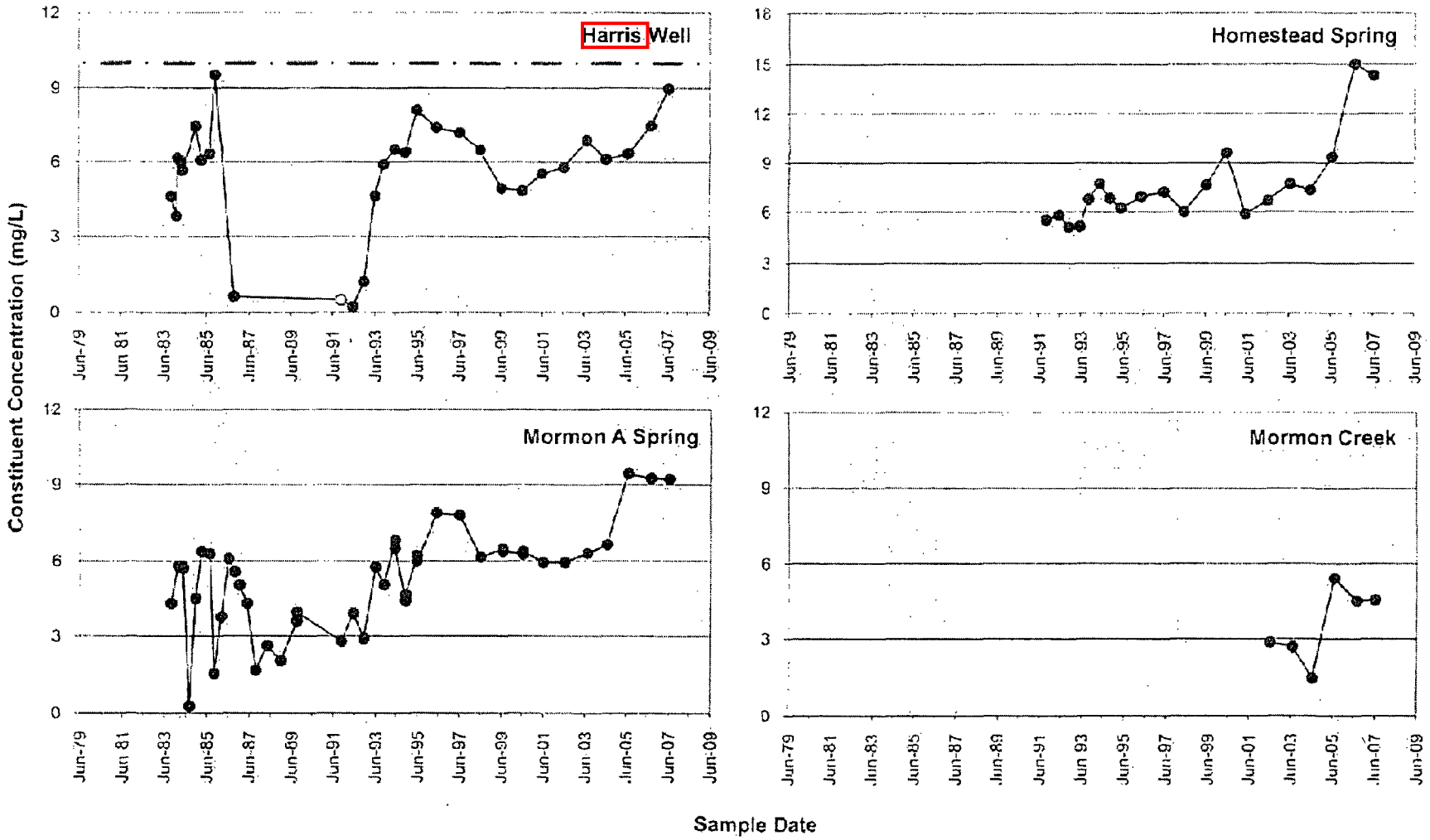
Nitrate in Southern Boundary Wells

FIGURE D-3

Constituent Concentration (mg/L)

Nitrate as N Remediation Goal (10 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

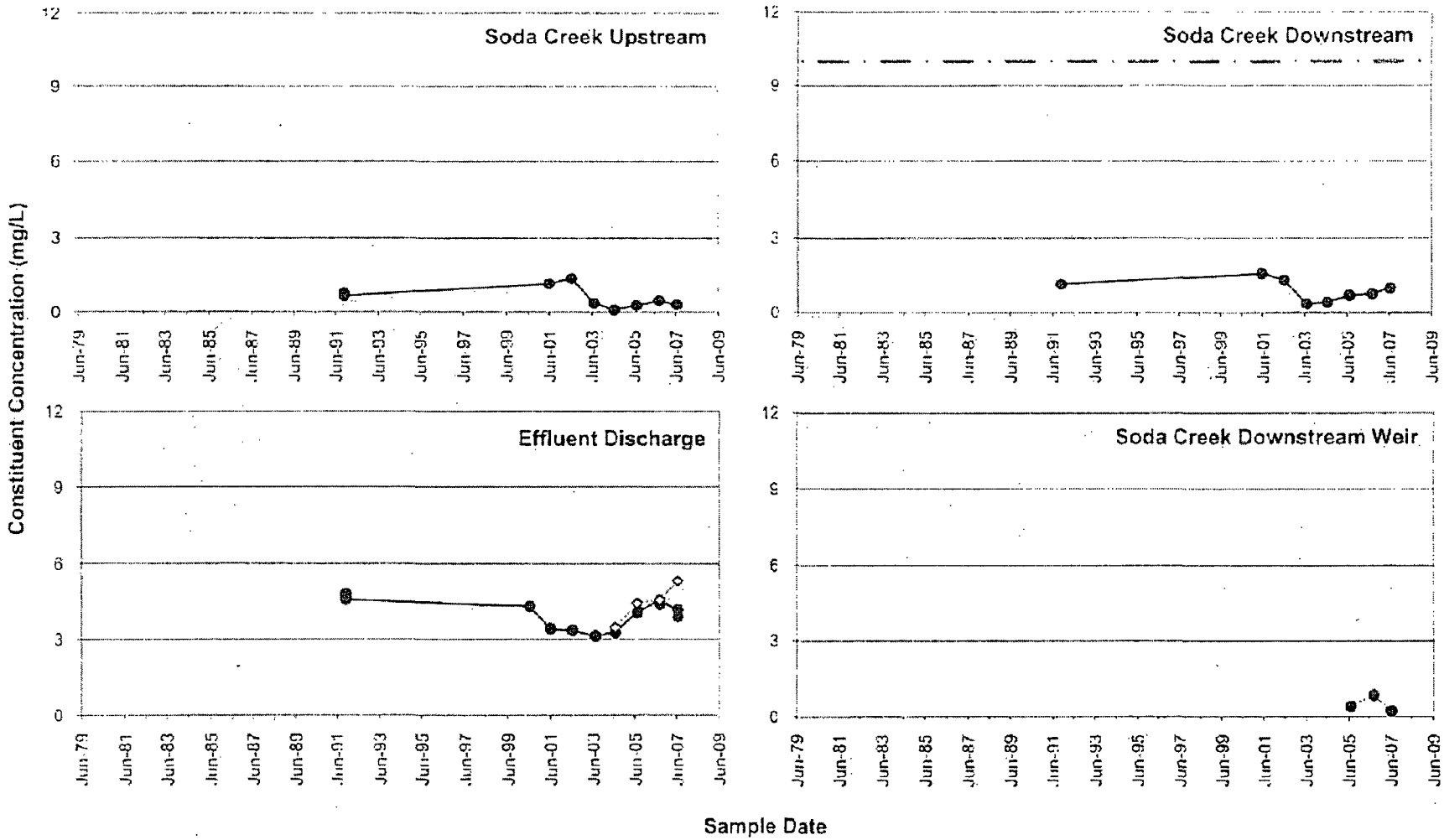
TITLE

Nitrate in Harris Well and Springs South of Plant

FIGURE D-4

Constituent Concentration (mg/L)
Non-Detects
Nitrate as N Remediation Goal (10 mg/L)

CLIENT	Monsanto Company	DRAWN	CH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

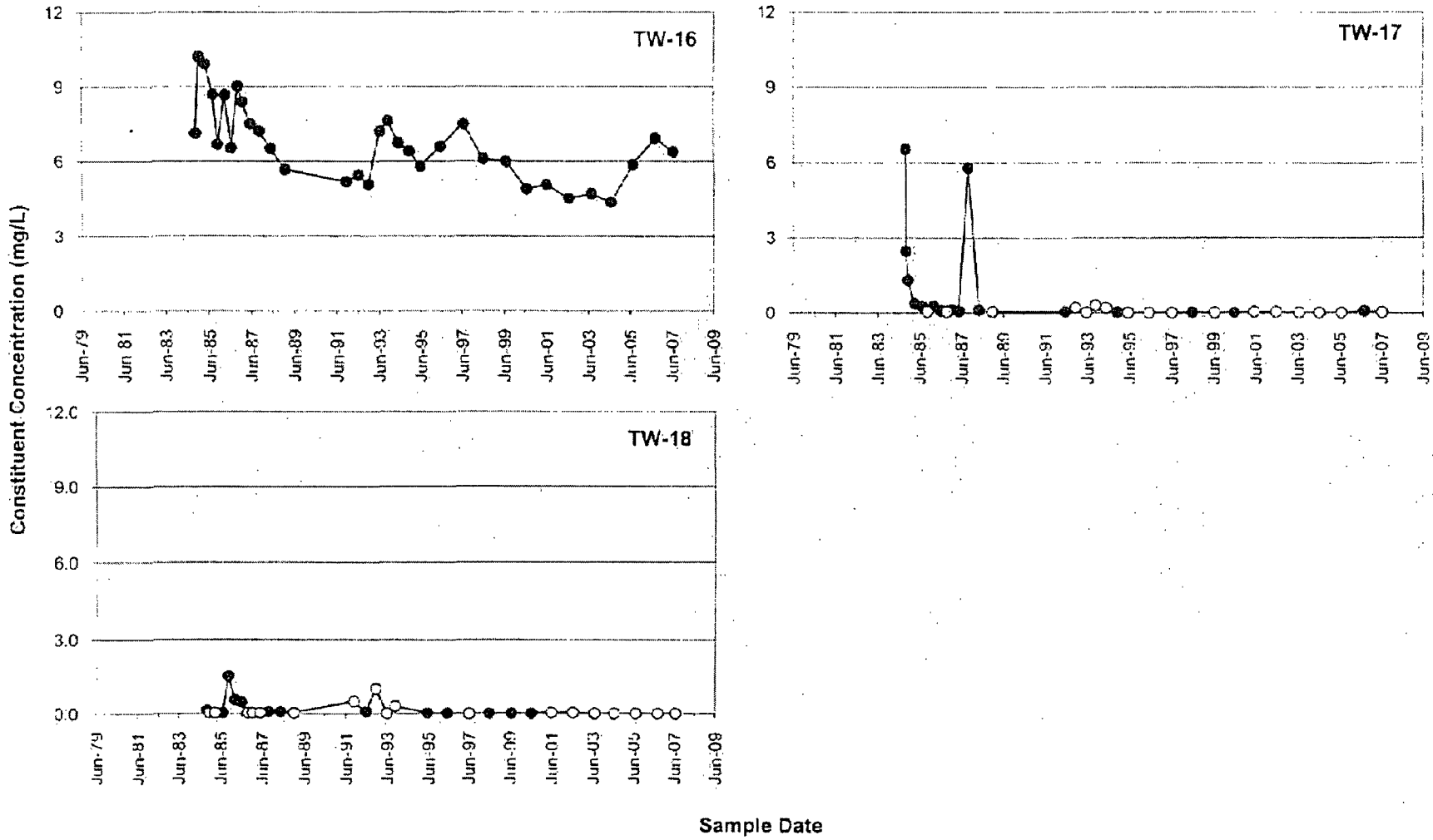
Golder Associates

TITLE **Nitrate in Soda Creek and Treatment Plant Effluent**

FIGURE D-5

Constituent Concentration (mg/L)
Nitrate as N Remediation Goal (10 mg/L)
Pond Inlet

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App C Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

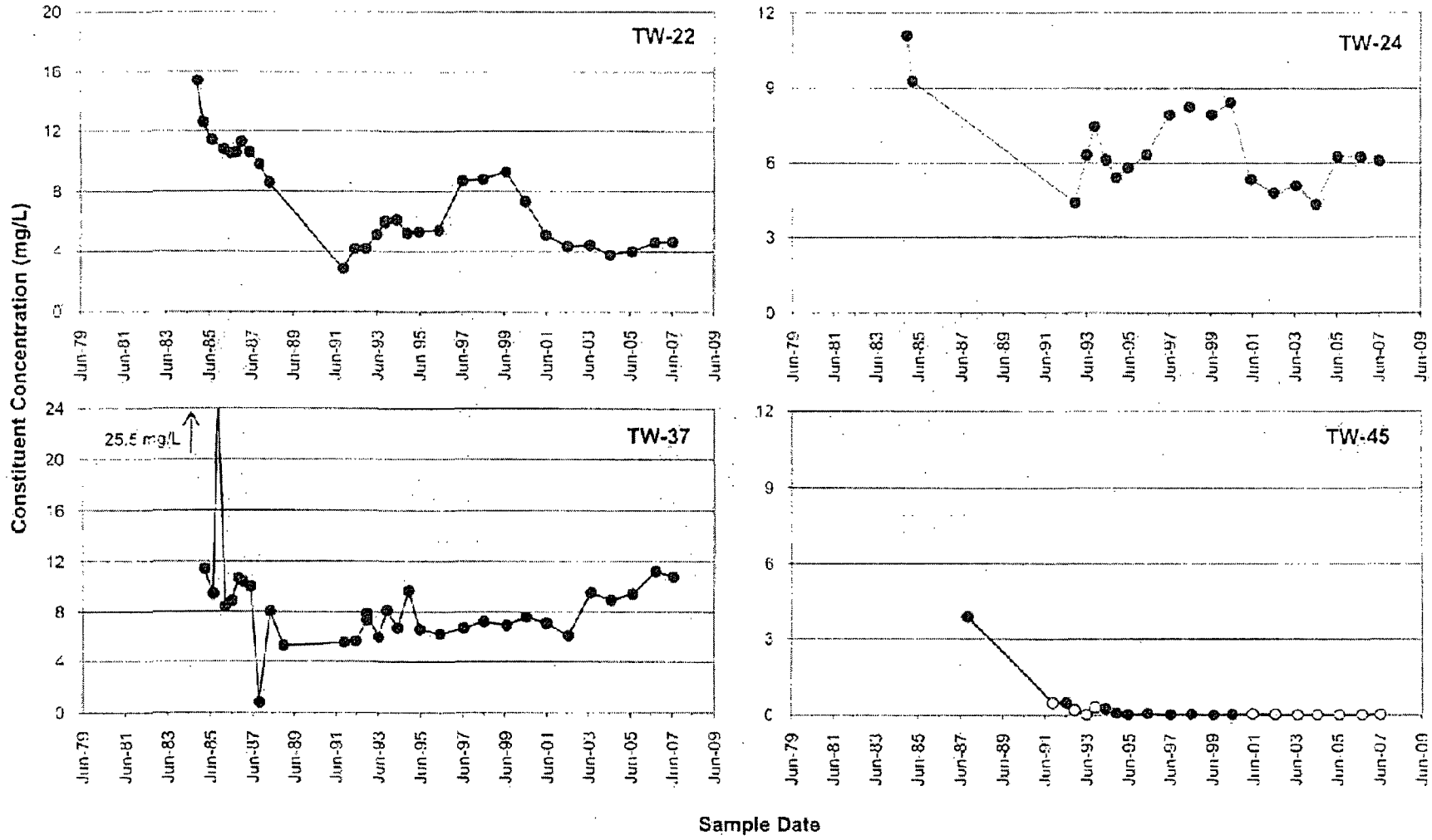
TITLE **Nitrate in NW Pond Wells**

FIGURE D-6

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	CH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

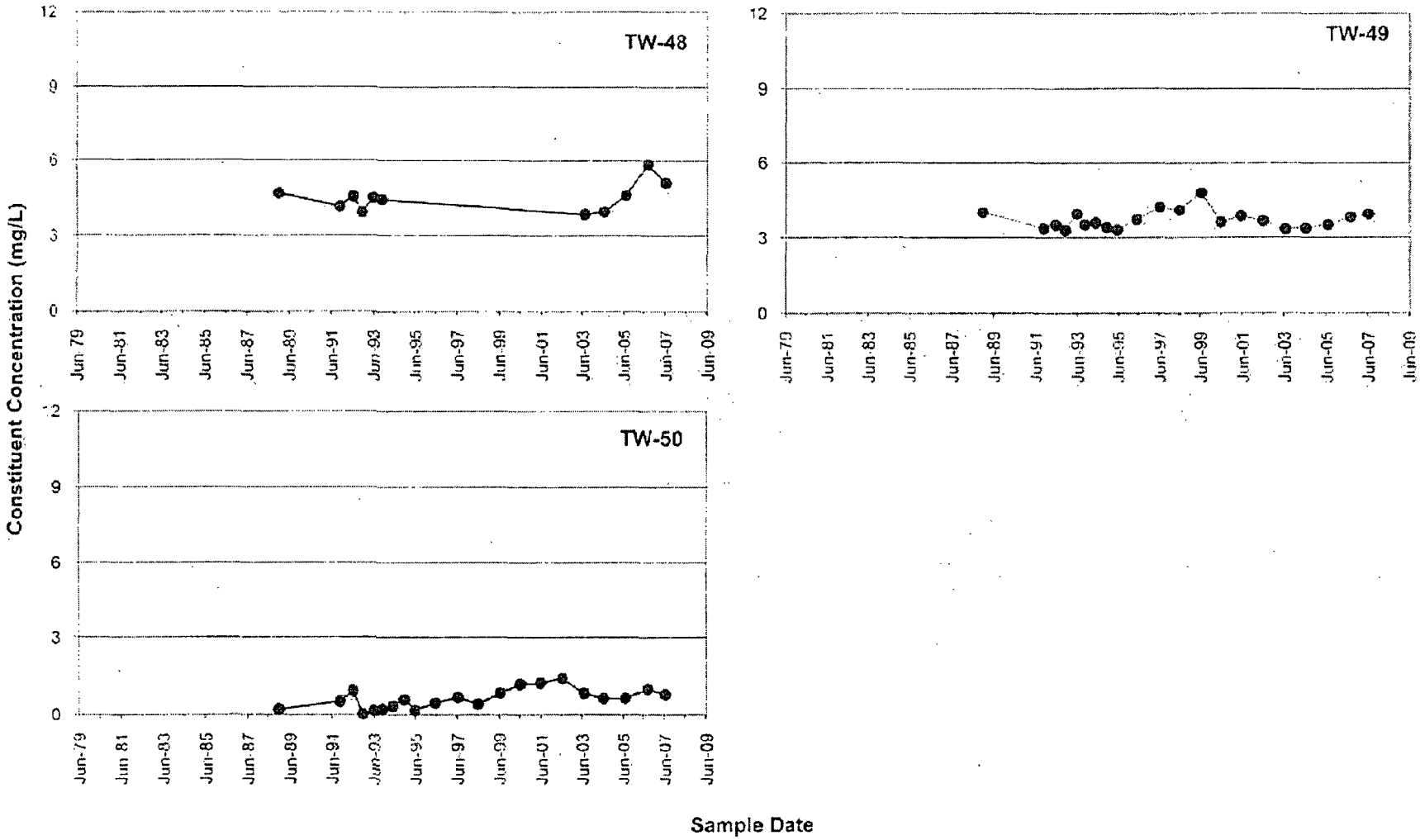
Nitrate in Old Underflow Solids Pond Area Wells

FIGURE D-7

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

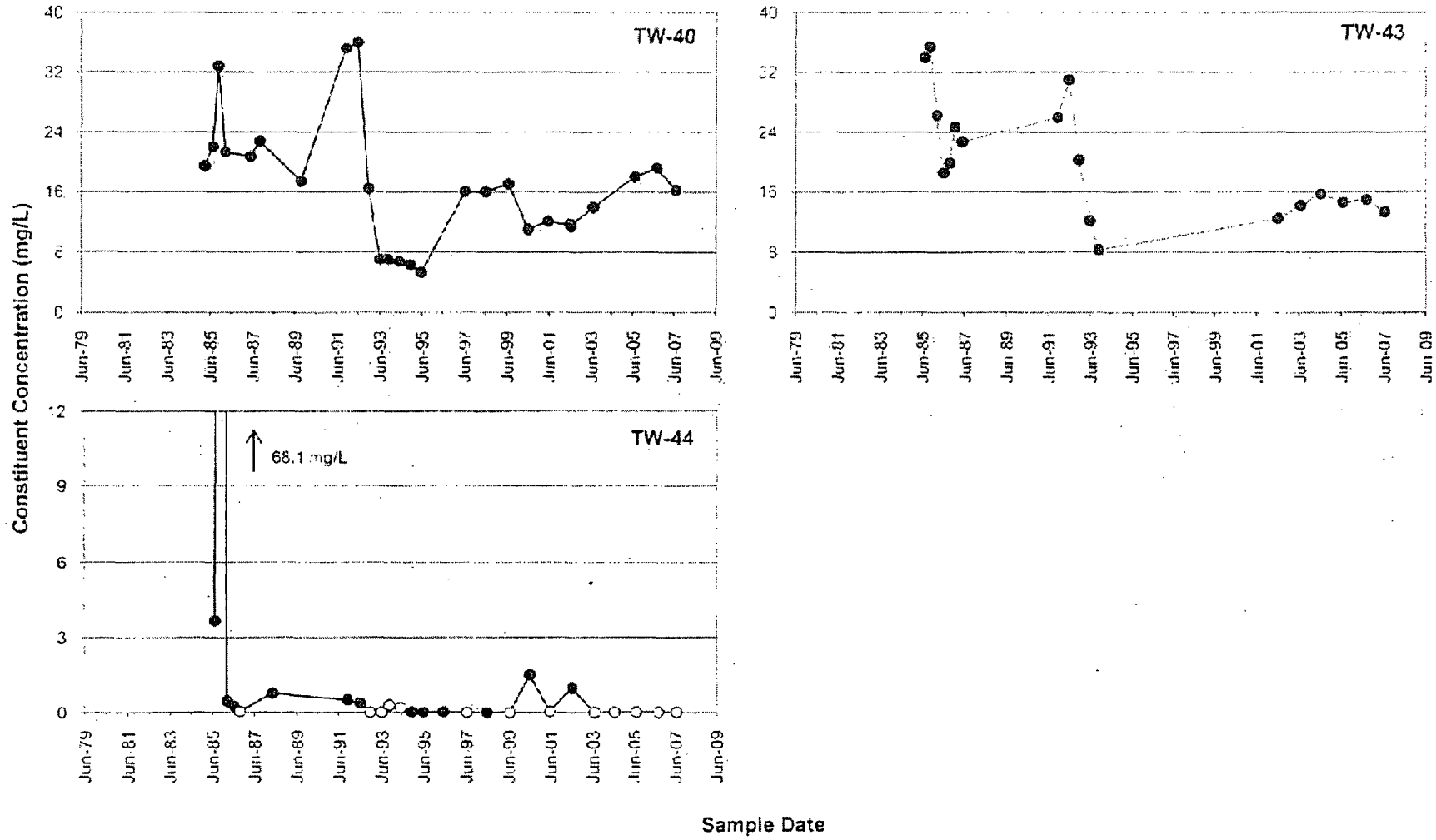
Nitrate in Underflow Solids Piles Area Wells

FIGURE D-8

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

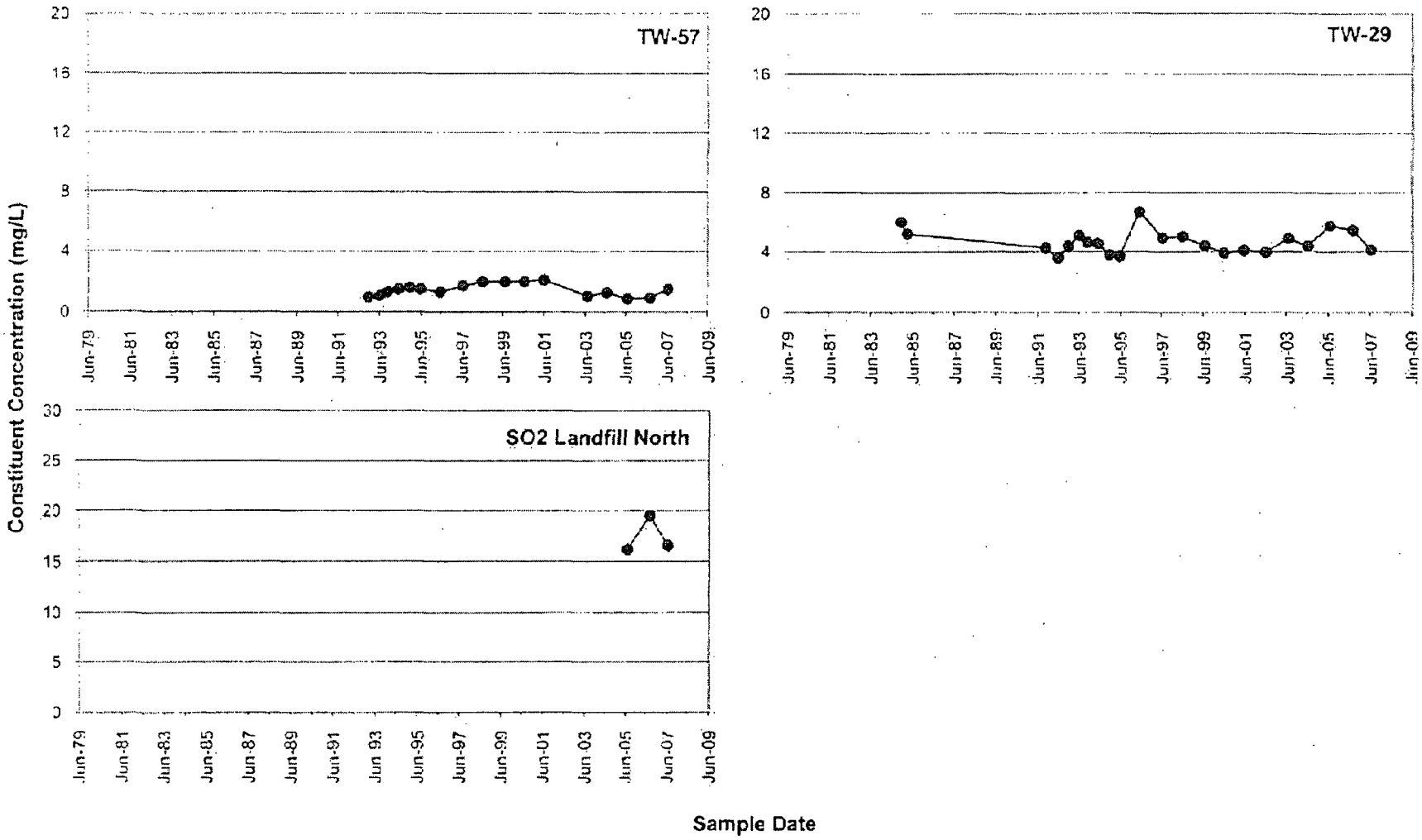
TITLE: Nitrate in Hydroclarifier Area Wells

FIGURE D-9

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

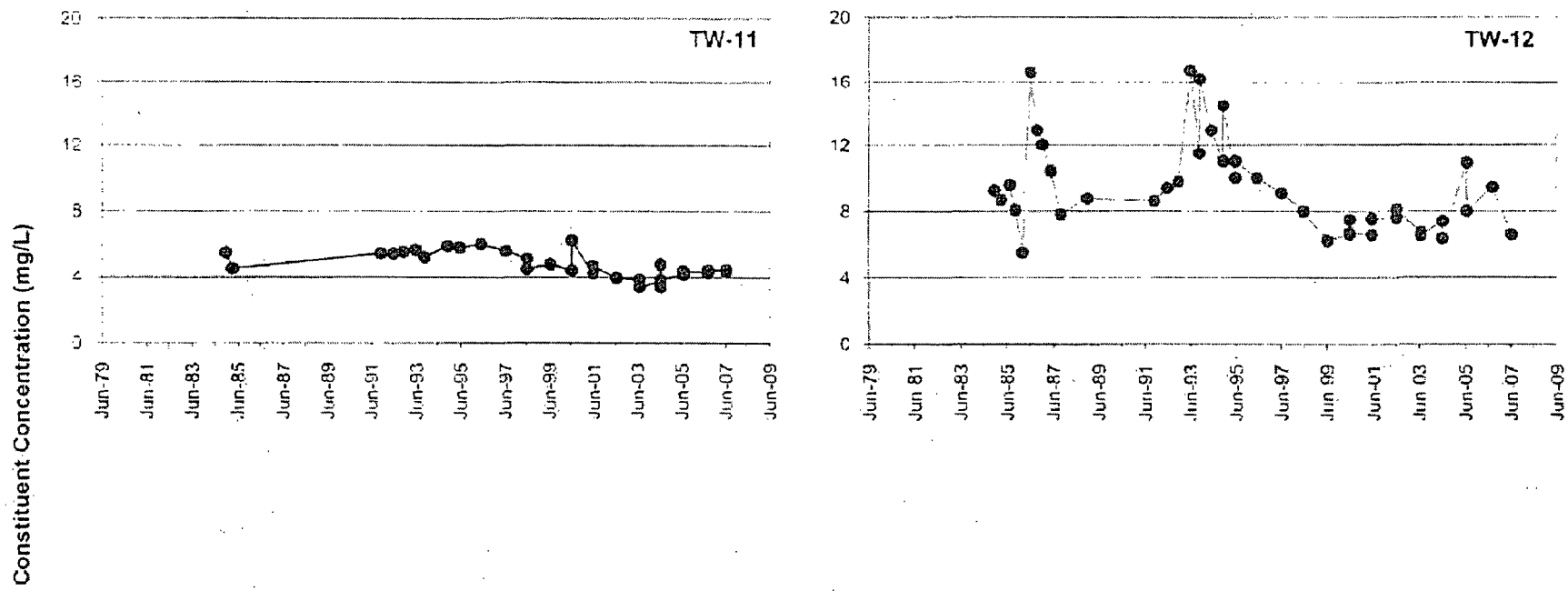
Nitrate in Background Wells

FIGURE D-10

—●— Constituent Concentration (mg/L)

○ Non-detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	013-1101 605A	DATE 29-Nov-07	REVIEWED DB



Sample Date

FILE NAME Apc D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

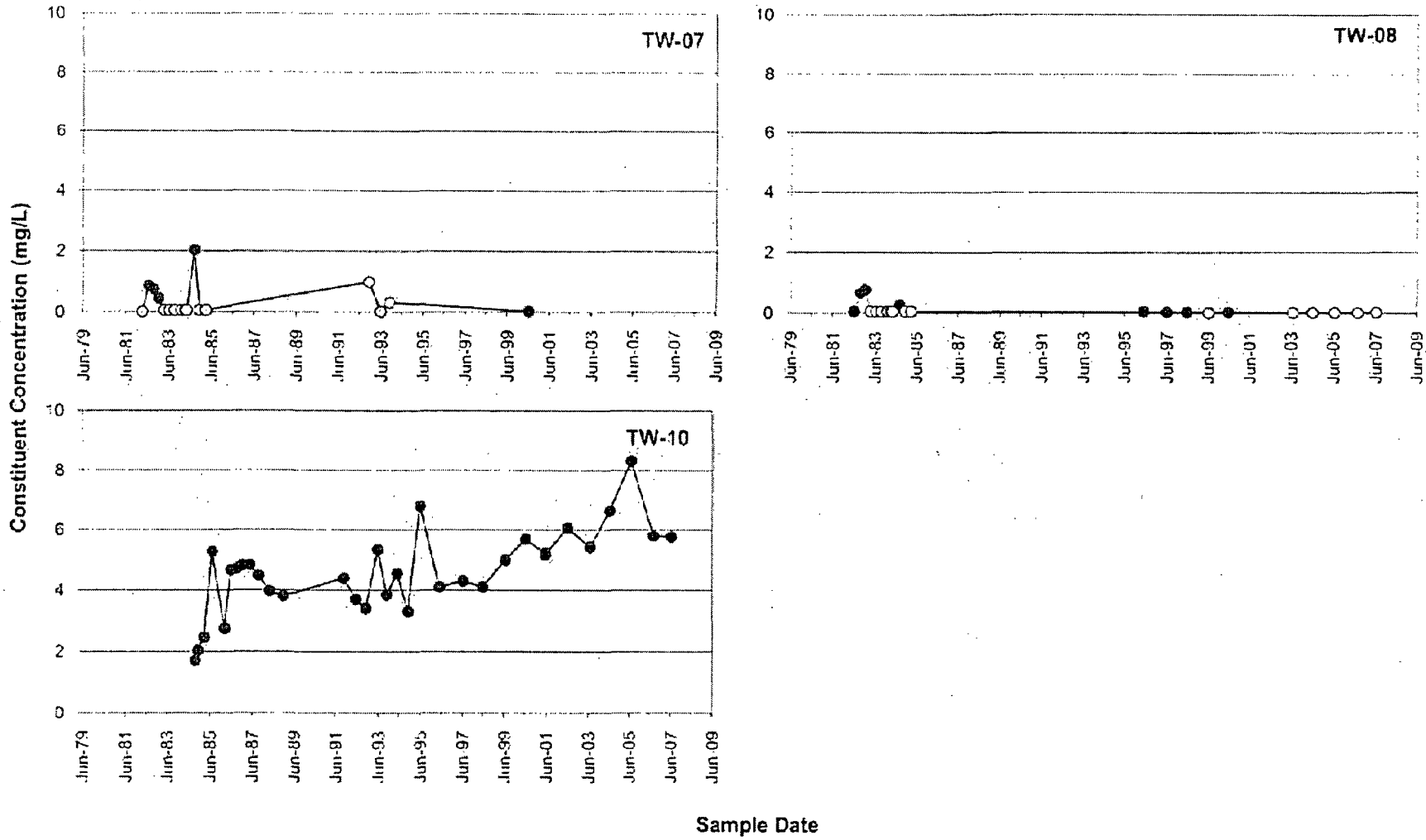
Golder Associates

TITLE Nitrate in Southeast Corner Wells

FIGURE D-11

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

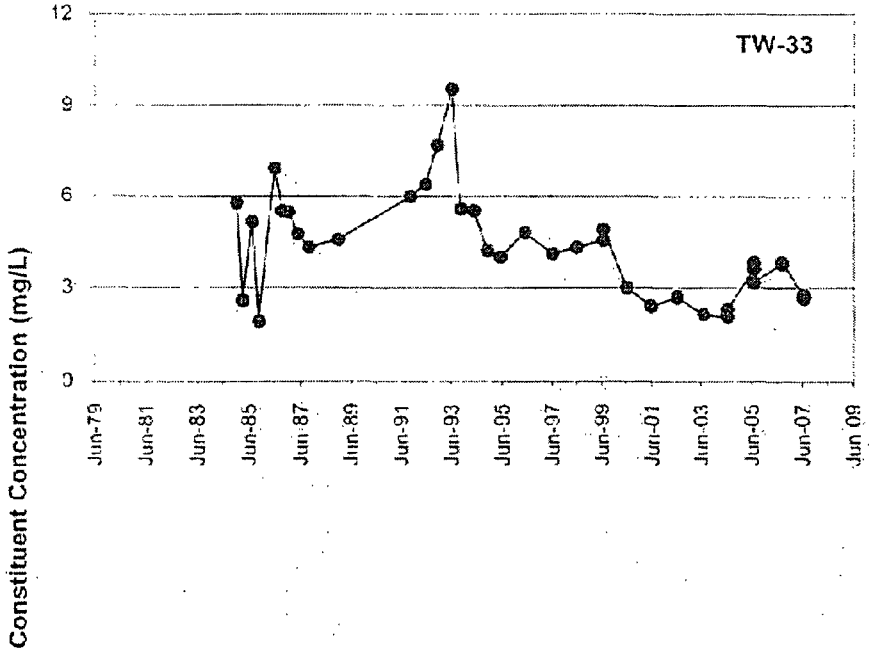
TITLE **Nitrate in Southwest Corner Wells**

FIGURE D-12

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



Sample Date

FILE NAME App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

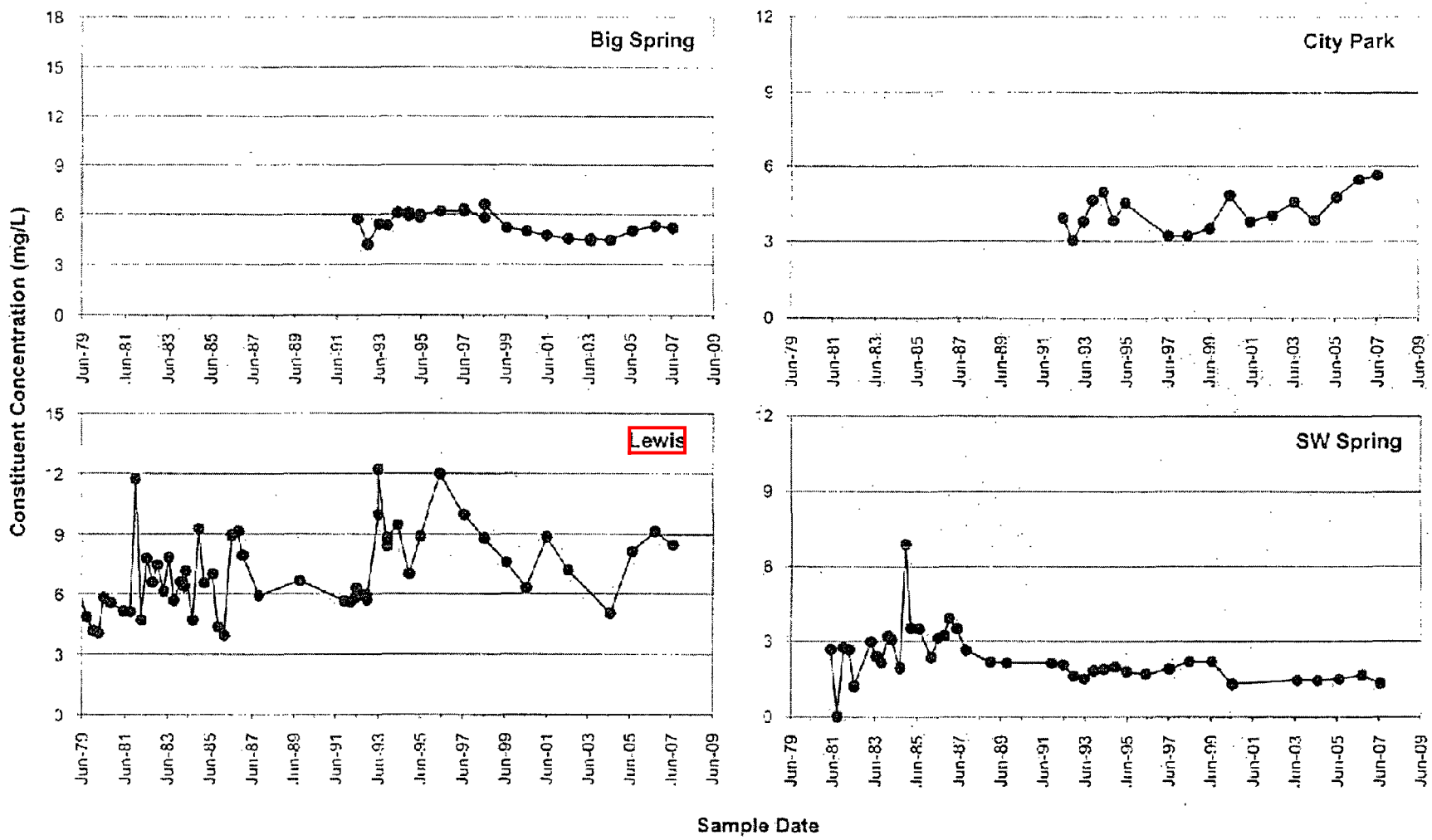
TITLE

Nitrate in East Area Wells

FIGURE D-13

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.305A	DATE 29-Nov-07	REVIEWED DB



FILE NAME: App D Nitrate Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

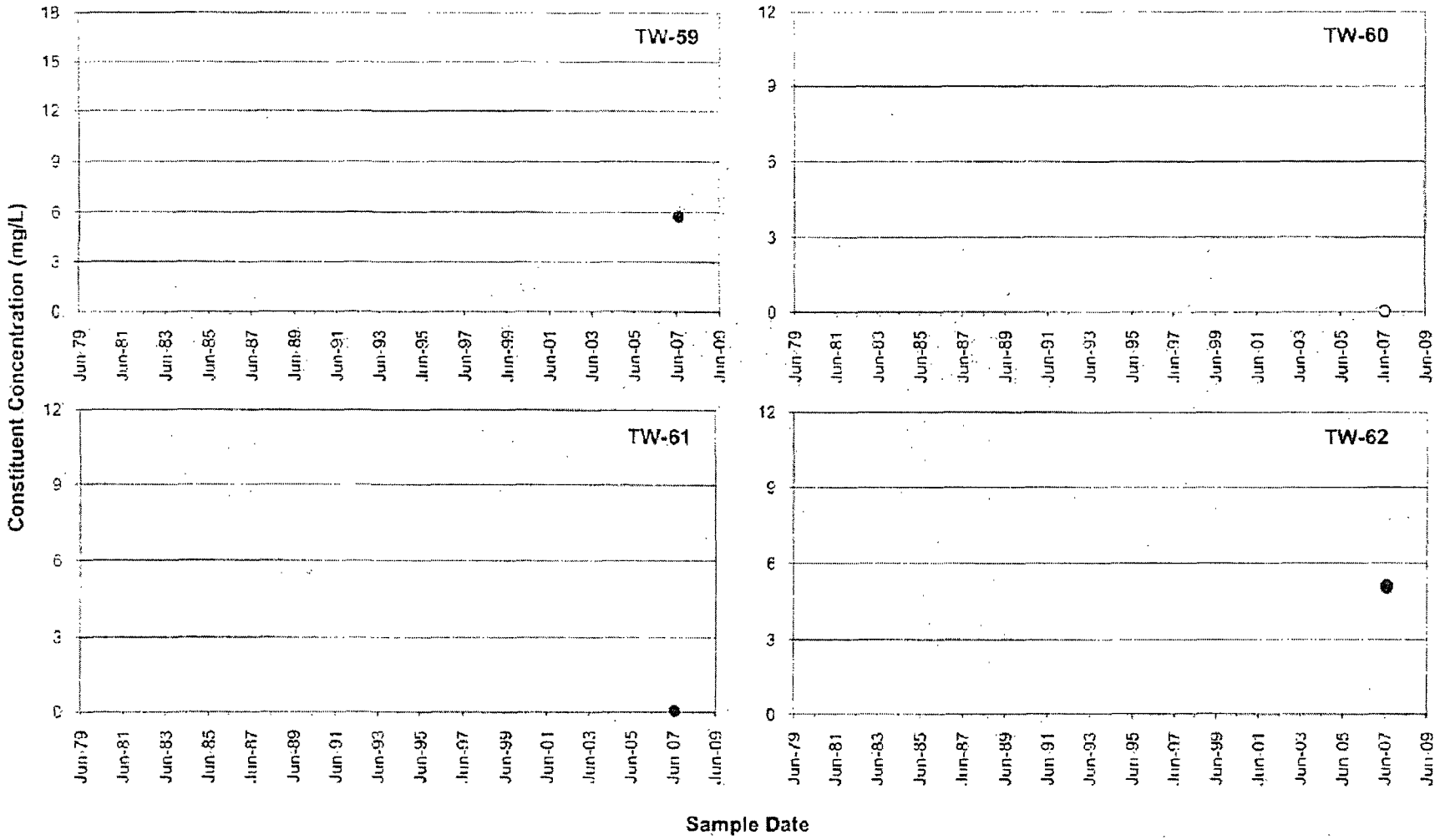
TITLE

Nitrate in Offsite Wells and Springs

FIGURE D-14

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App D Nitrate Charts 2007 x's

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Nitrate in 2007 Monitoring Wells**

FIGURE D-15

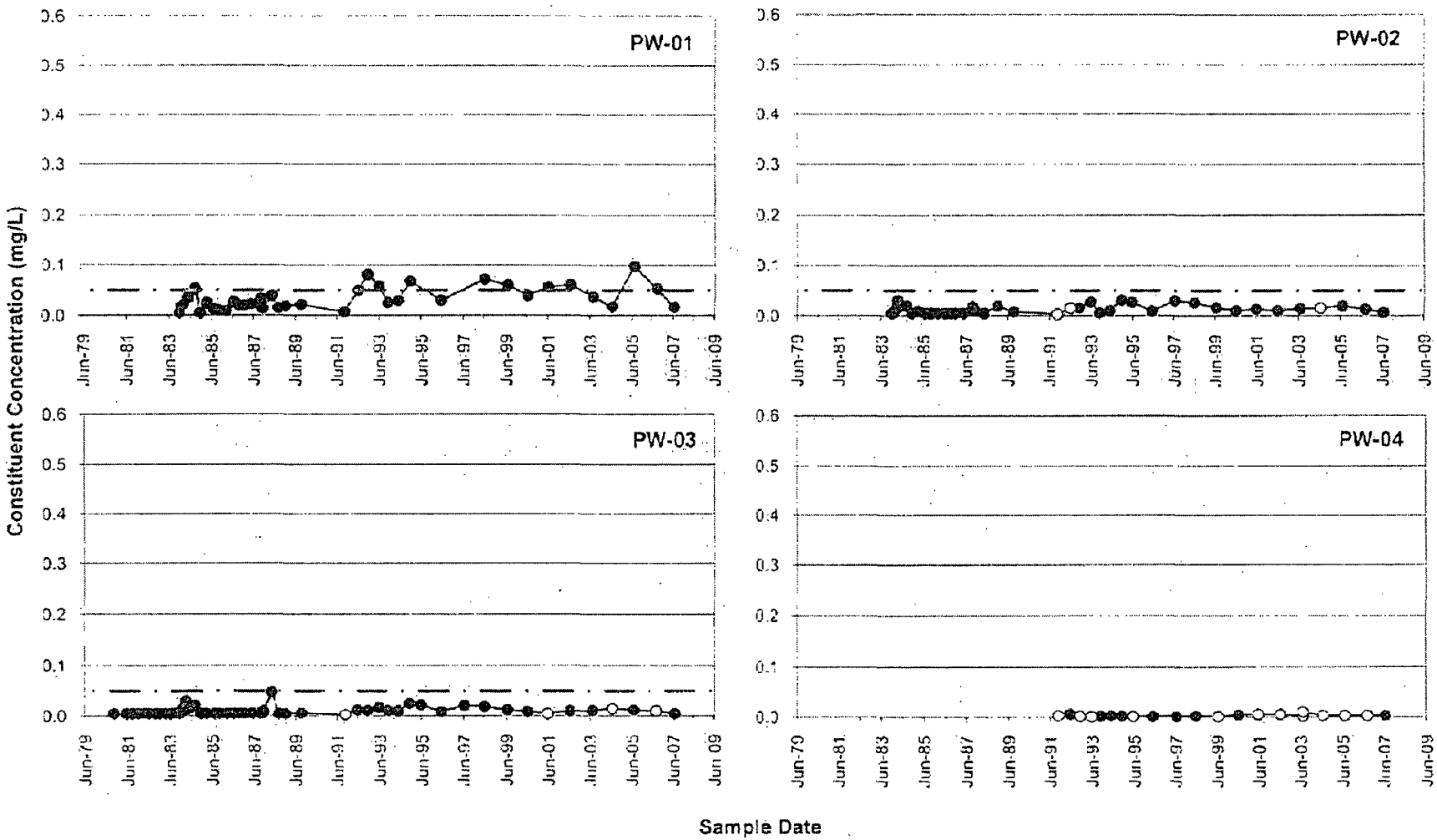
—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.305A	DATE 29-Nov-07	REVIEWED DB

APPENDIX E

TIME-HISTORY GRAPHS FOR SELENIUM



FILE NAME App E Selenium Charts 2007 x s

Remediation goals shown for point of compliance locations only

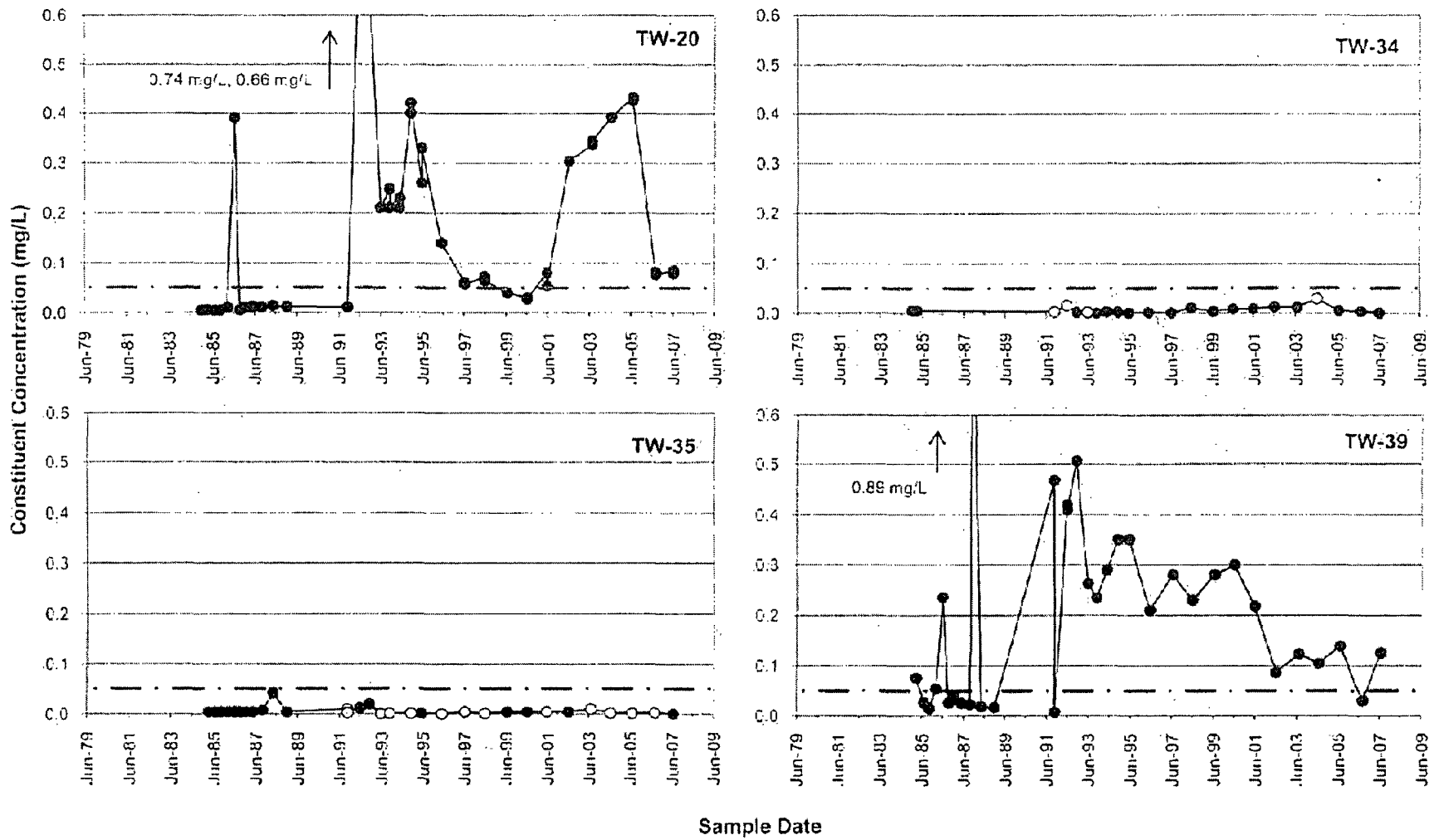
Golder Associates

TITLE **Selenium in Production Wells**

FIGURE E-1

Constituent Concentration (mg/L)
Non-detect
Selenium Remediation Goal (0.05 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

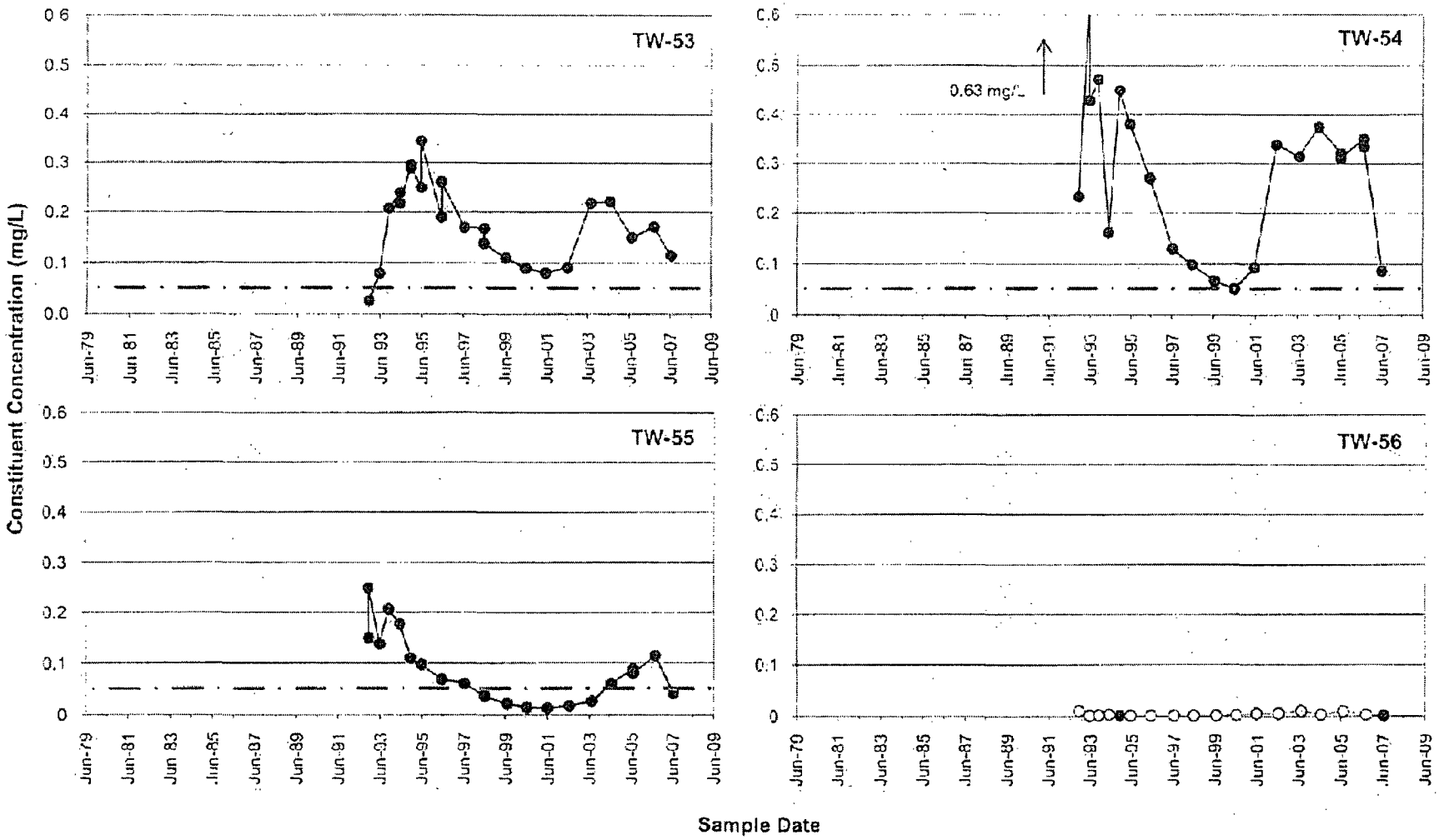
Golder Associates

TITLE **Selenium in South Fenceline Wells**

FIGURE E-2

Constituent Concentration (mg/L)
Non-Detects
Selenium Remediation Goal (0.05 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME Asp E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Selenium in Southern Boundary Wells**

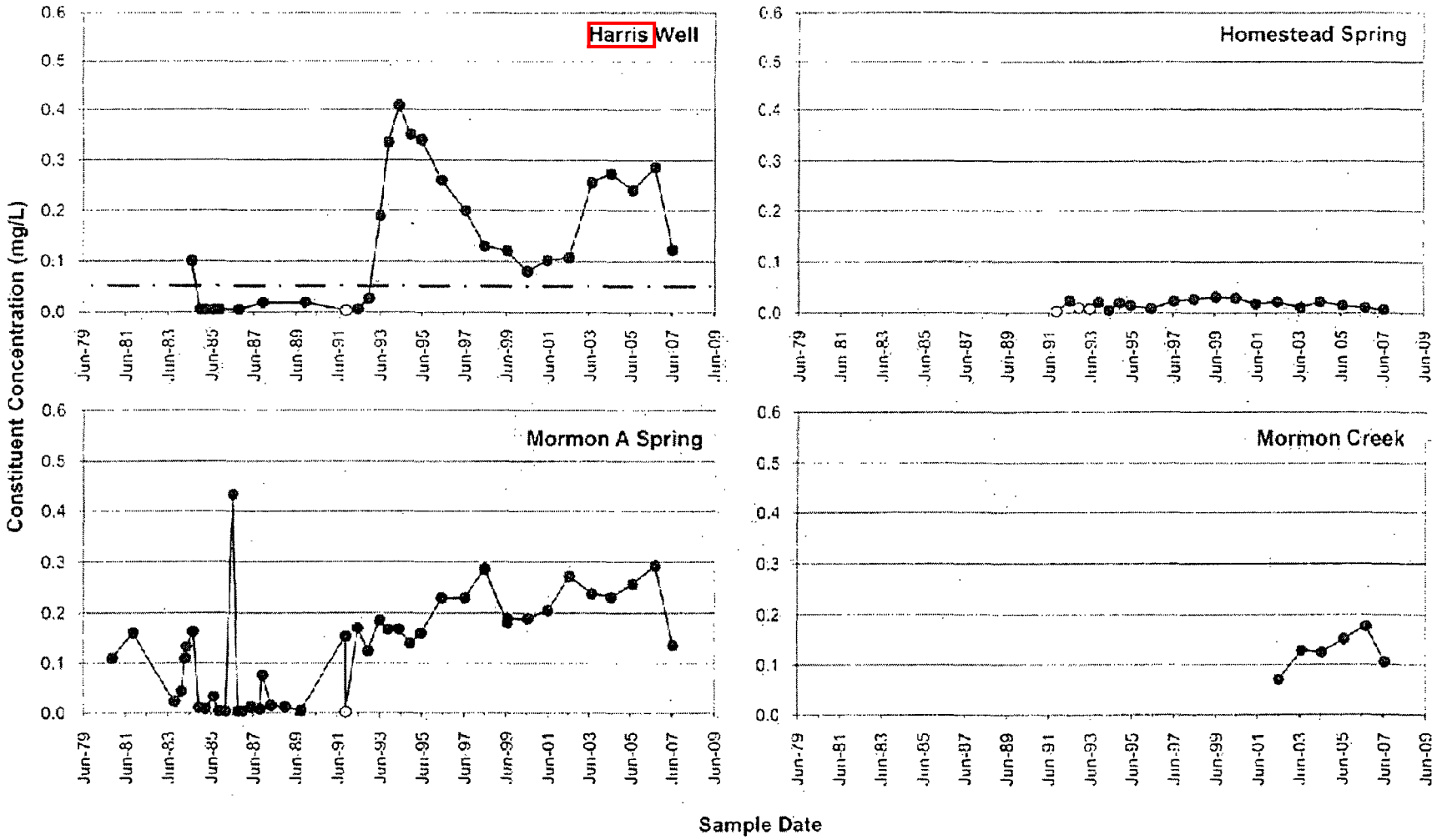
FIGURE **E-3**

Constituent Concentration (mg/L)

Non-Detects

Selenium Remediation Goal (0.05 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



FILE NAME App E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

Selenium in Harris Well and Springs South of Plant

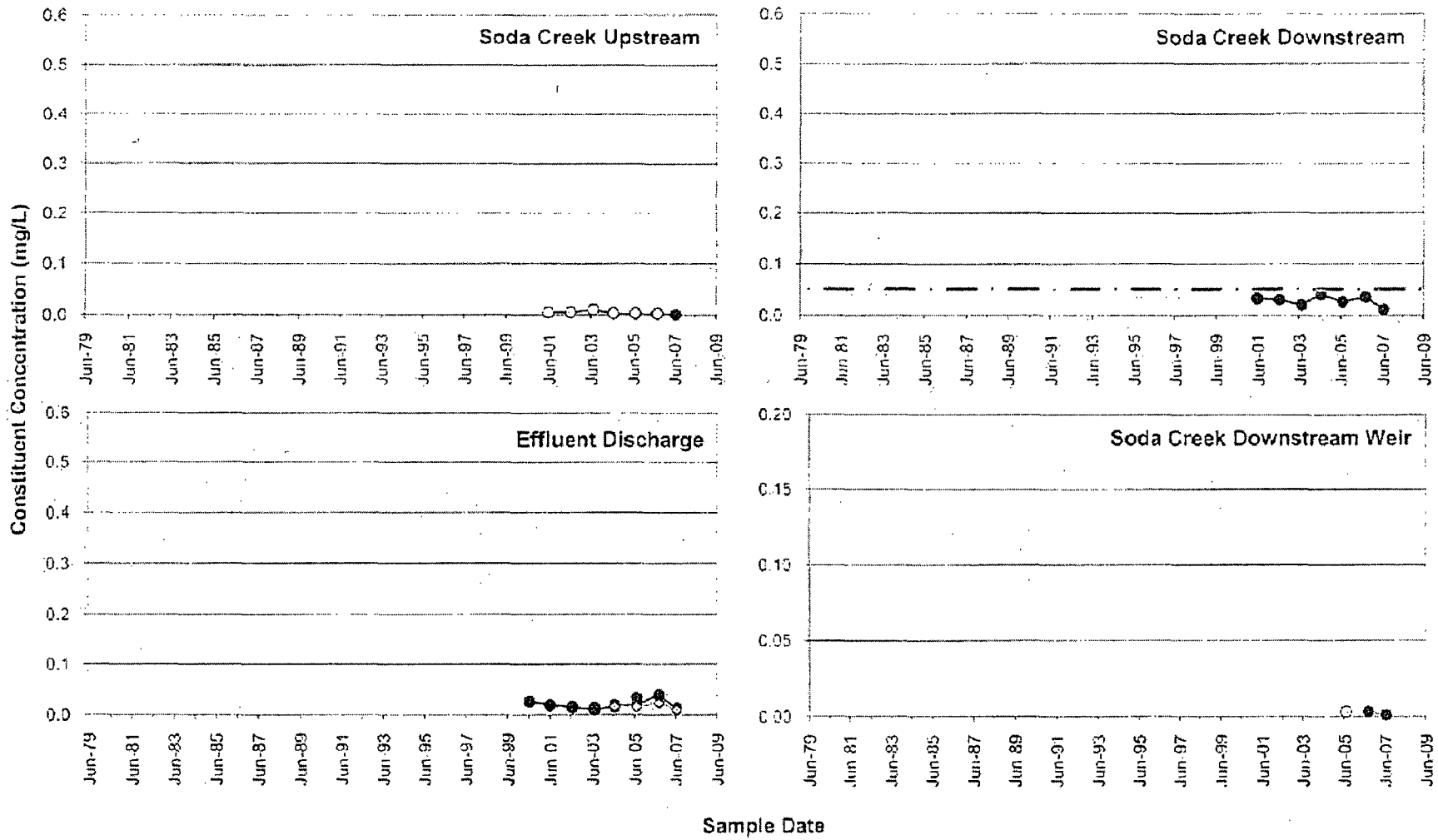
FIGURE E-4

Constituent Concentration (mg/L)

Non-Detects

Selenium Remediation Goal (0.05 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME Acp E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

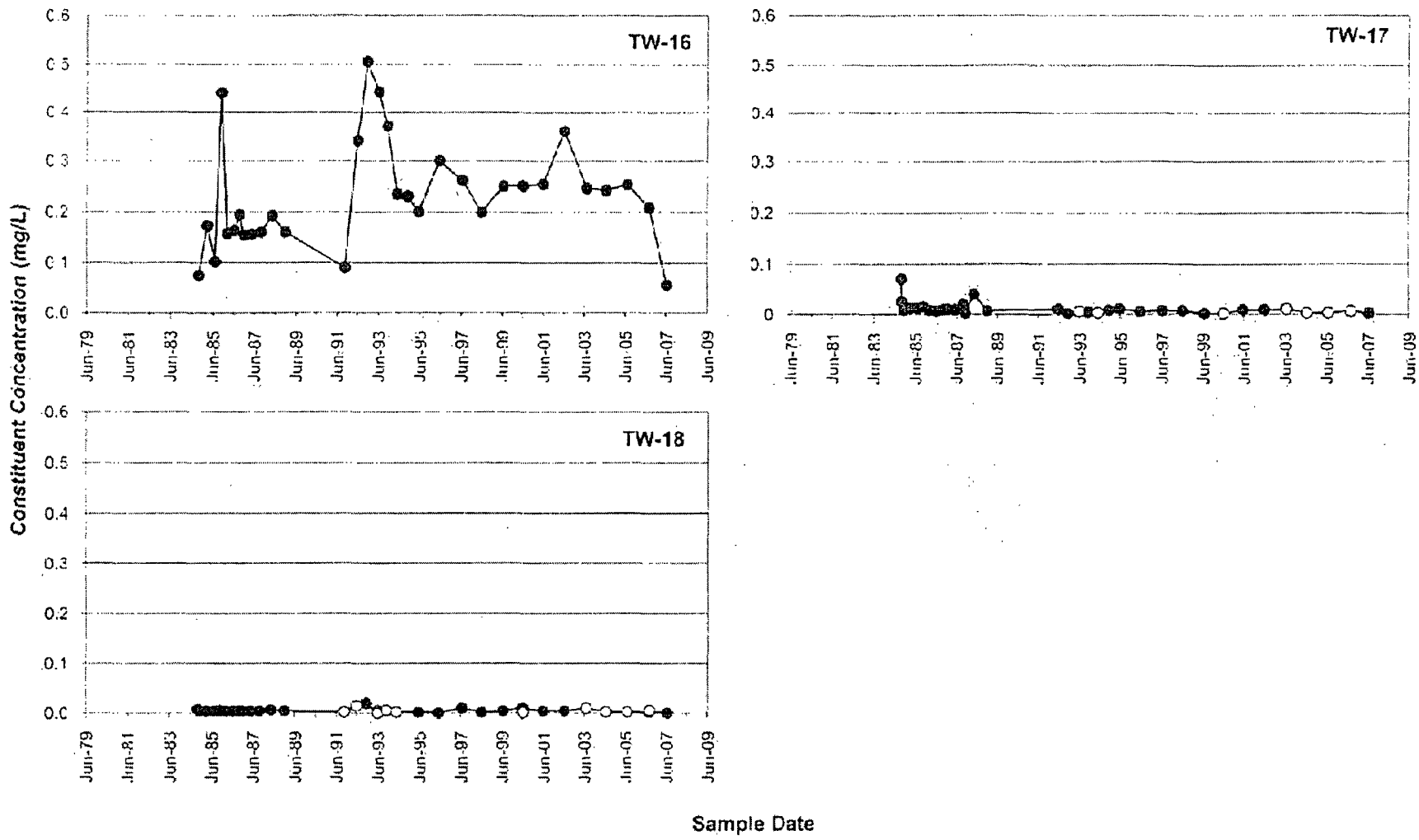
Golder Associates

TITLE **Selenium in Soda Creek and Treatment Plant Effluent**

FIGURE **E-5**

Constituent Concentration (mg/L)
Non-Detects
Pond Inlet
Selenium Remediation Goal (0.05 mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

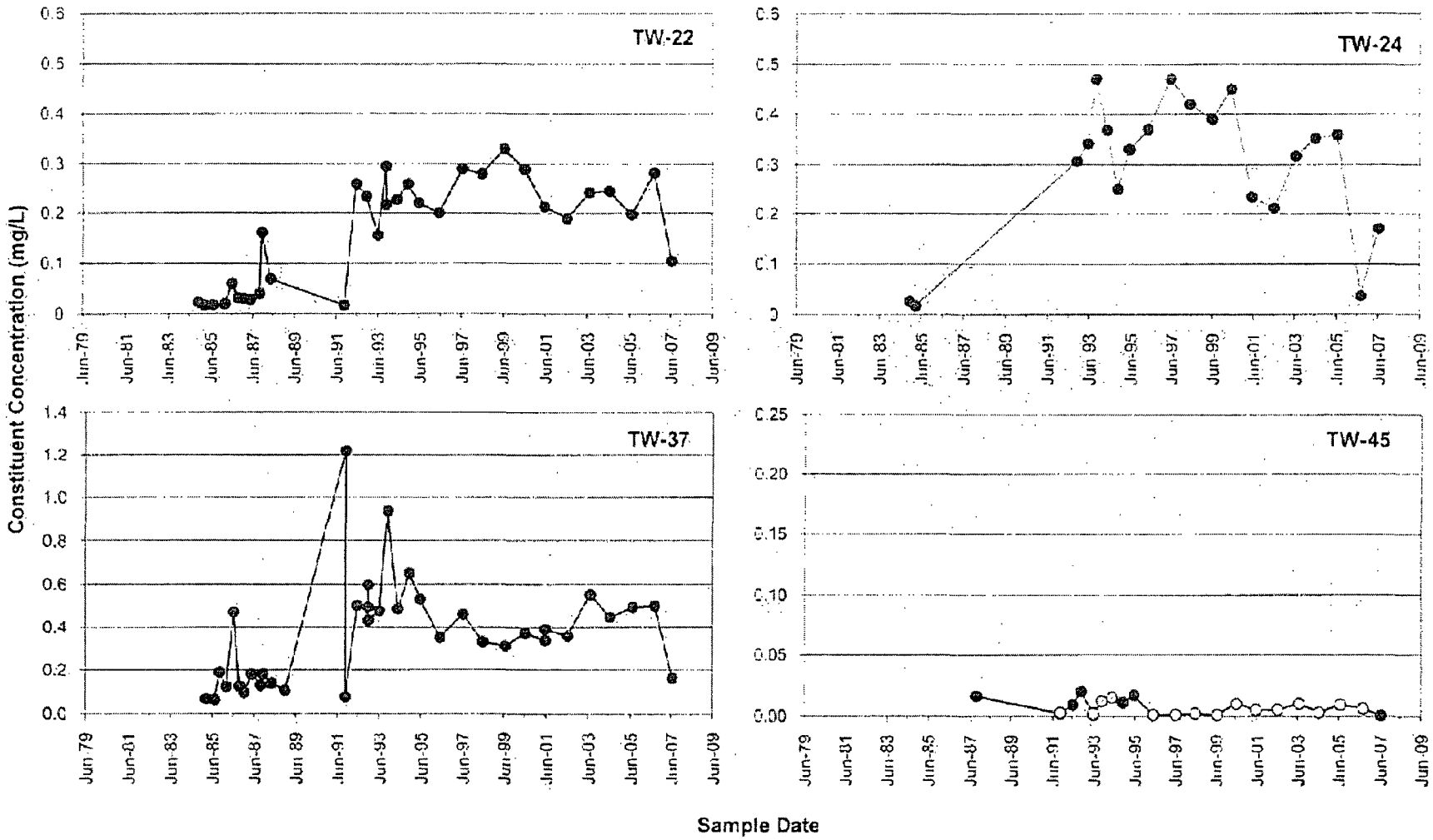
TITLE **Selenium in NW Pond Wells**

FIGURE E-6

Constituent Concentration (mg/L)

o Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

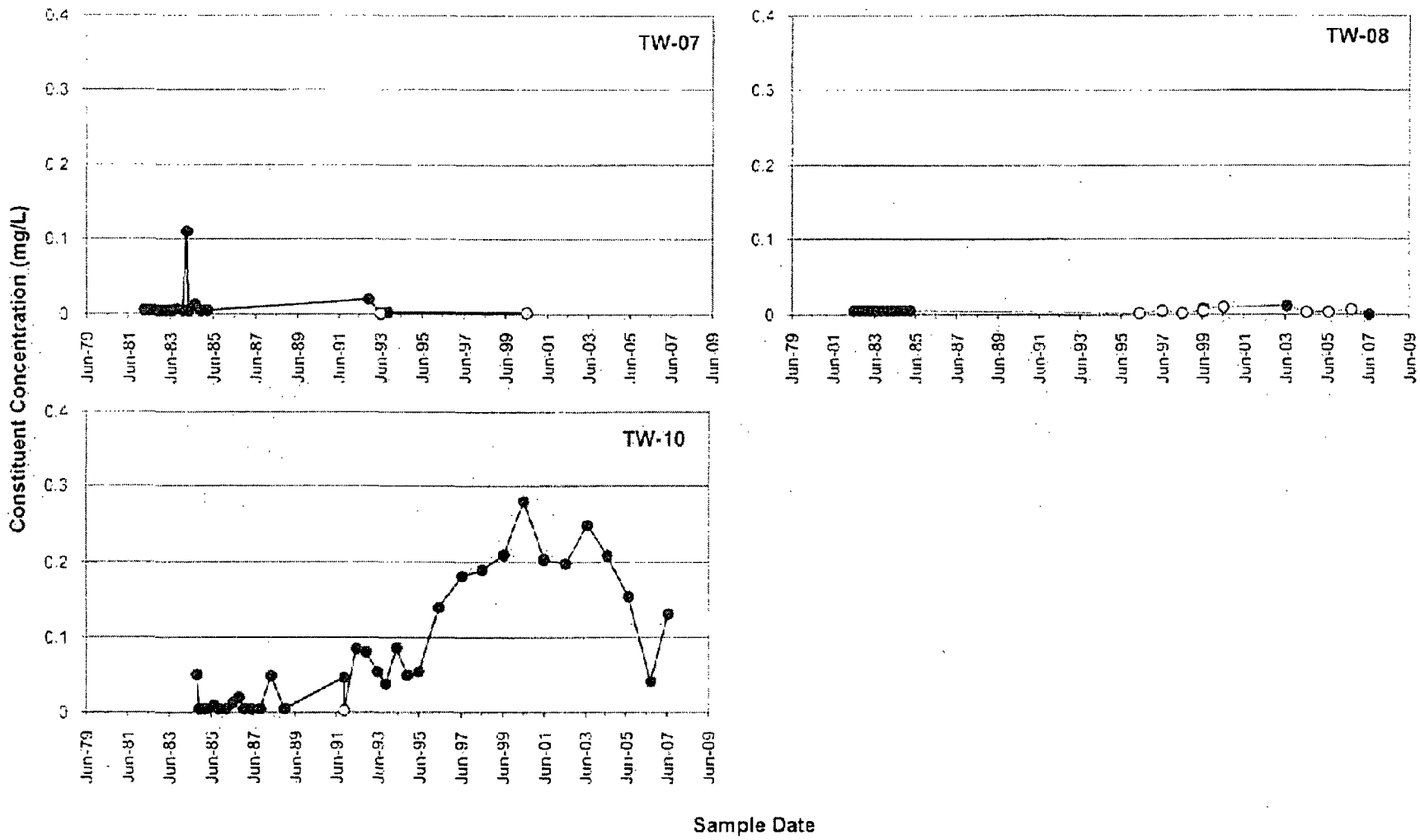
TITLE **Selenium in Old Underflow Solids Pond Area Wells**

FIGURE E-7

Constituent Concentration (mg/L)

Non-detect

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



FILE NAME App E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Selenium in Southwest Corner Wells**

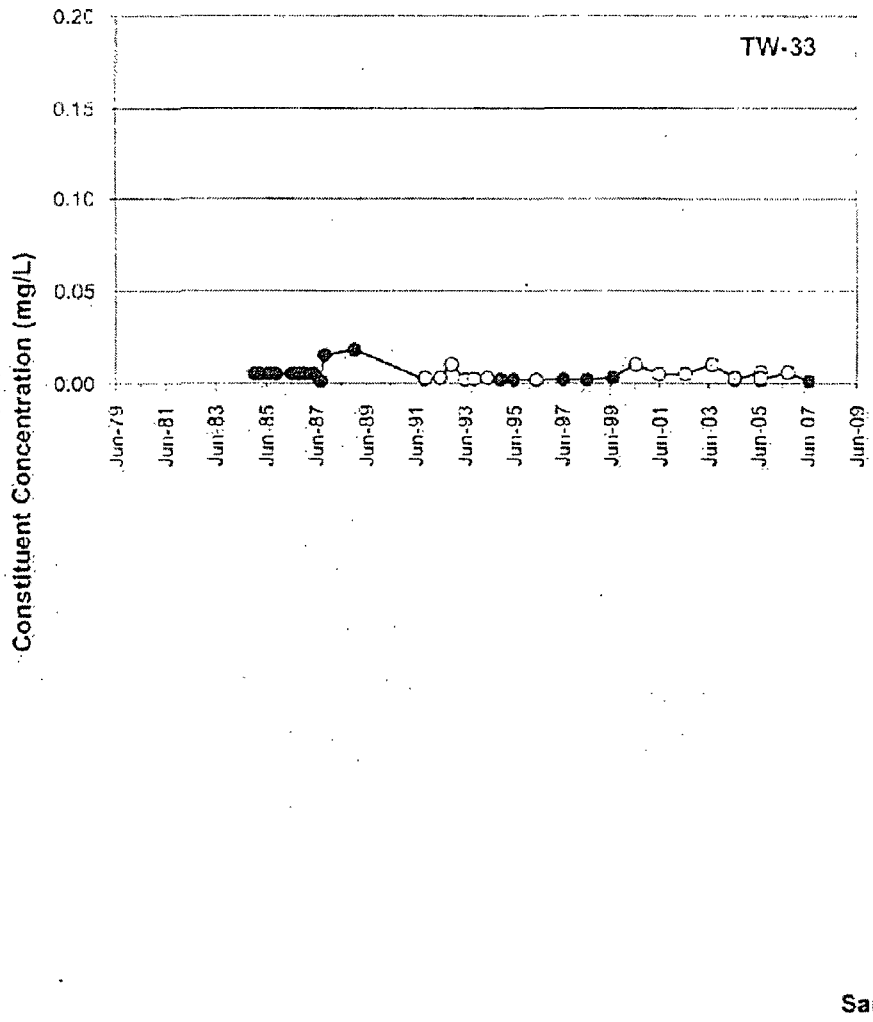
—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company		
PROJECT	Monsanto Groundwater Monitoring		
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	

FIGURE E-12

DRAWN	DH
CHECKED	MPK
REVIEWED	DB



FILE NAME App E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

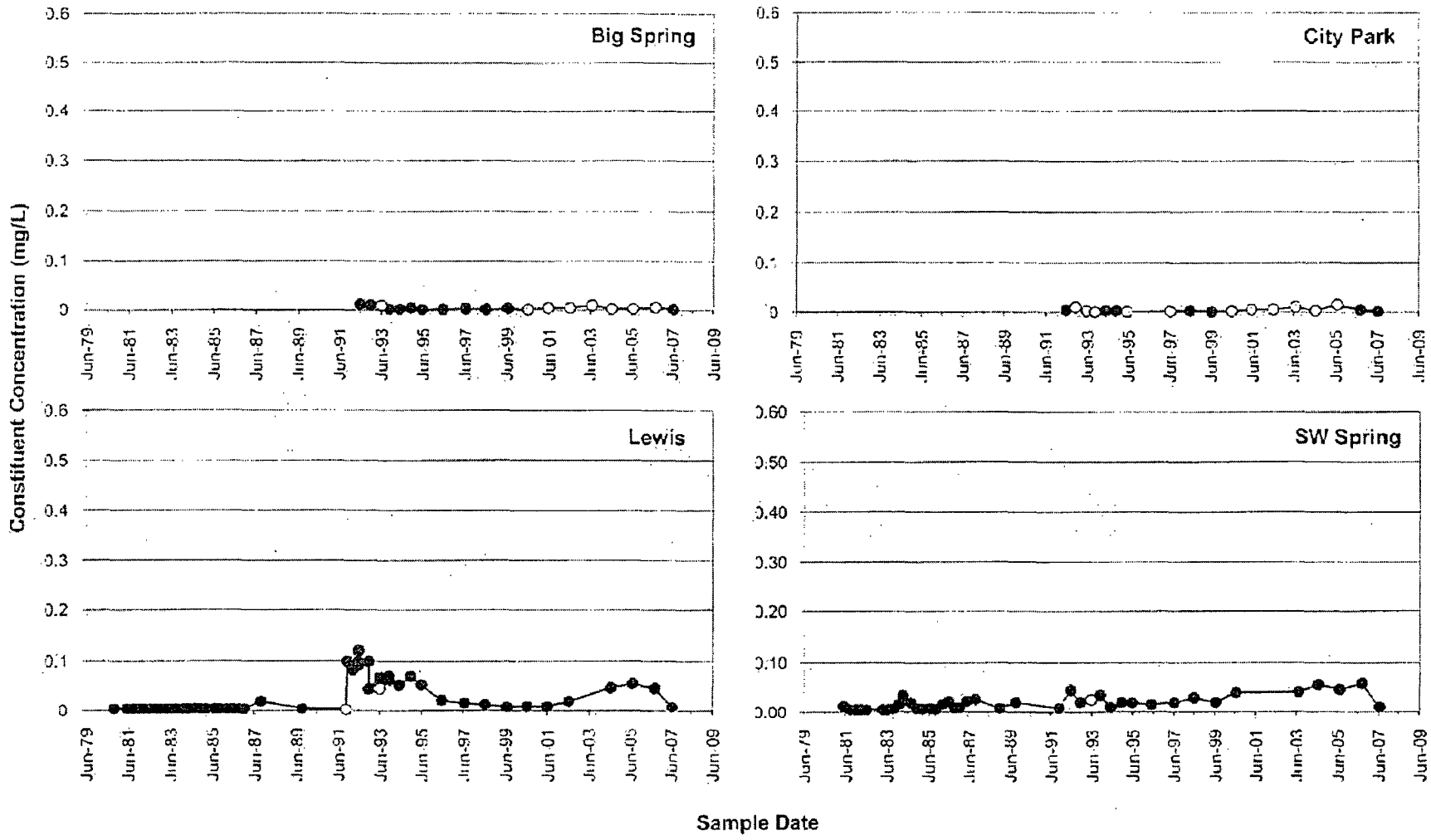
TITLE **Selenium in East Wells**

FIGURE E-13

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



FILE NAME Acp E Selenium Charts 2007 x s

Remediation goals shown for point of compliance locations only

Golder Associates

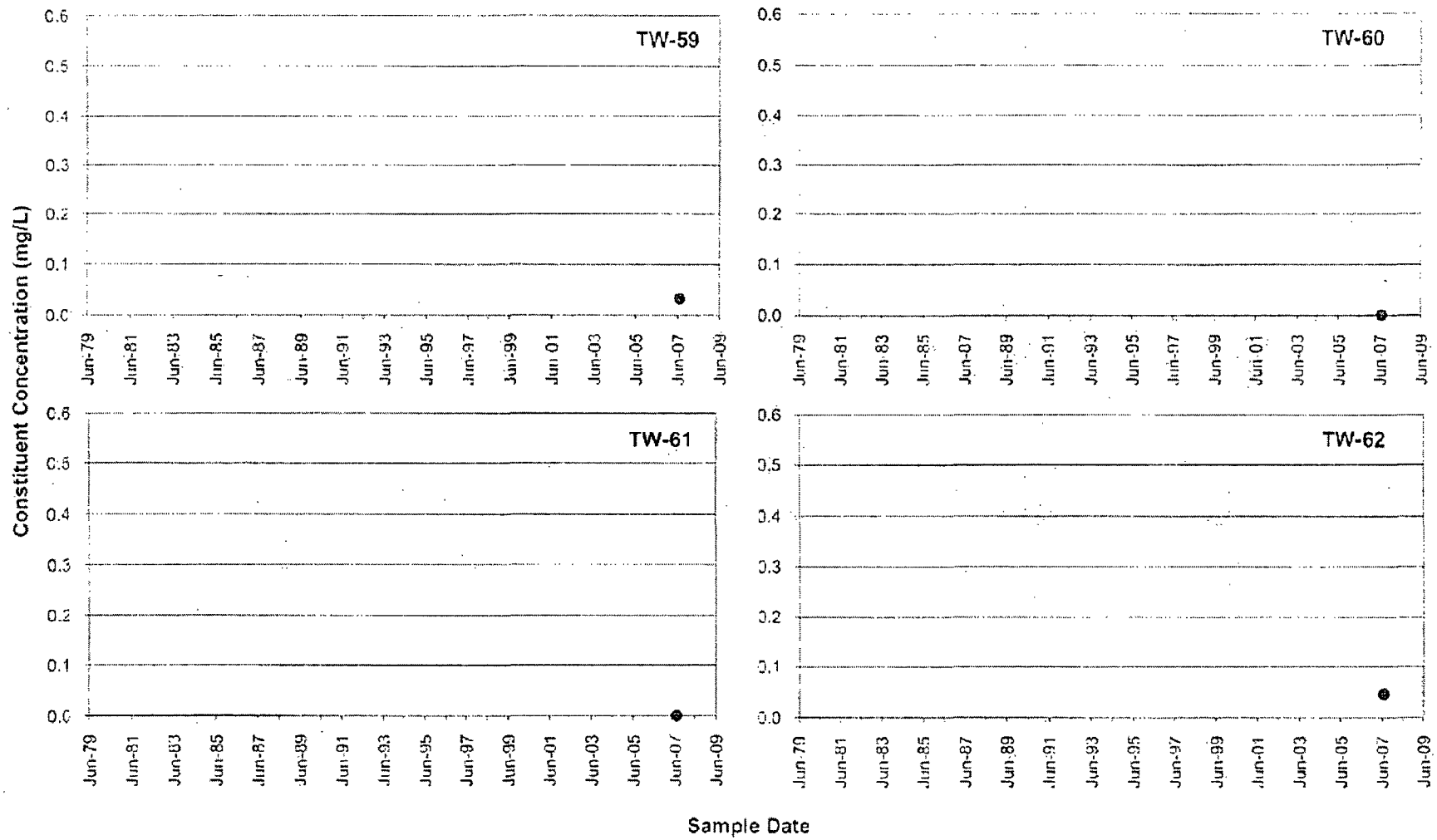
TITLE **Selenium in Offsite Wells and Springs**

FIGURE E-14

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App E Selenium Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Selenium in 2007 Monitoring Wells**

FIGURE **E-15**

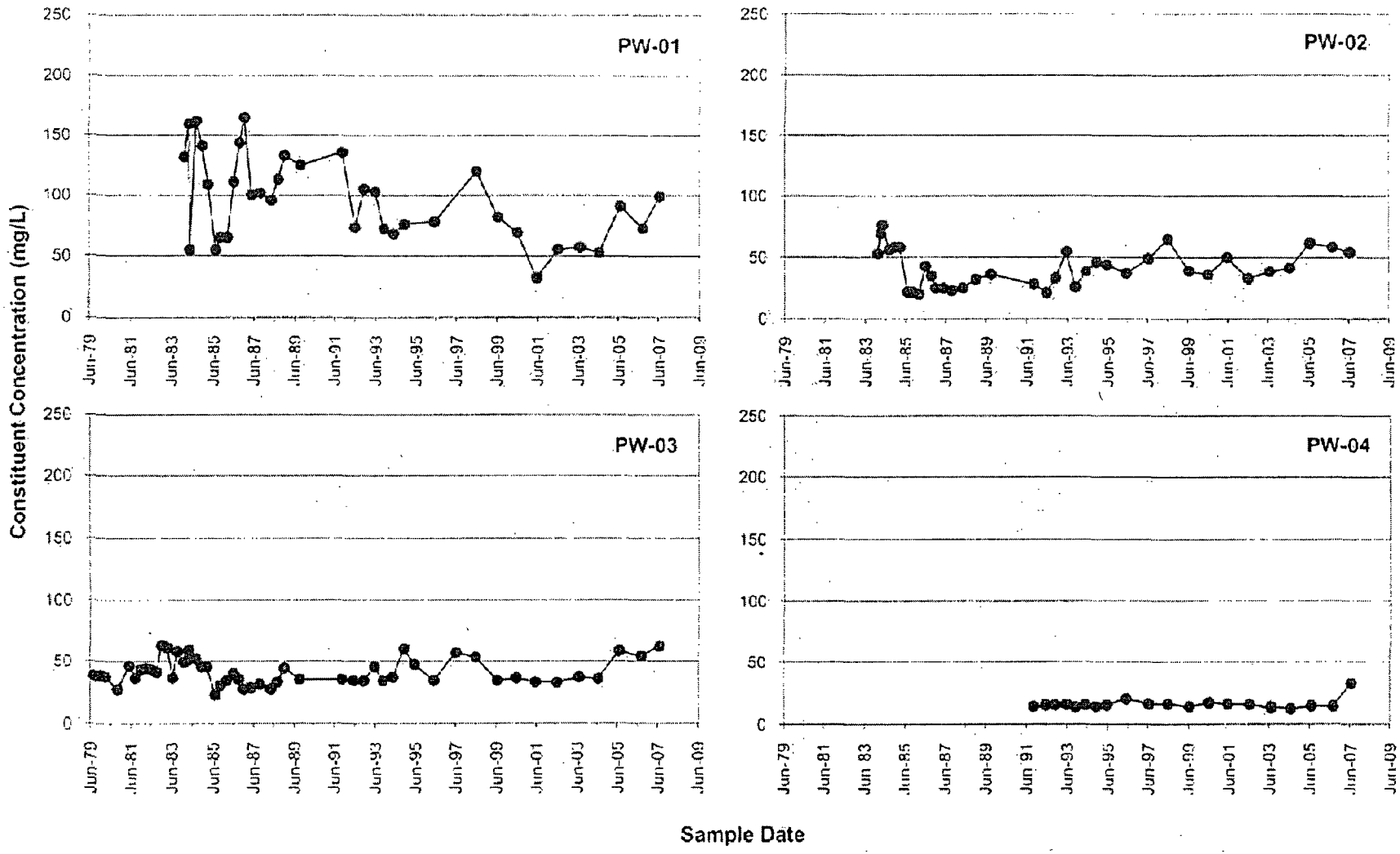
Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DE

APPENDIX F

TIME-HISTORY GRAPHS FOR CHLORIDE



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

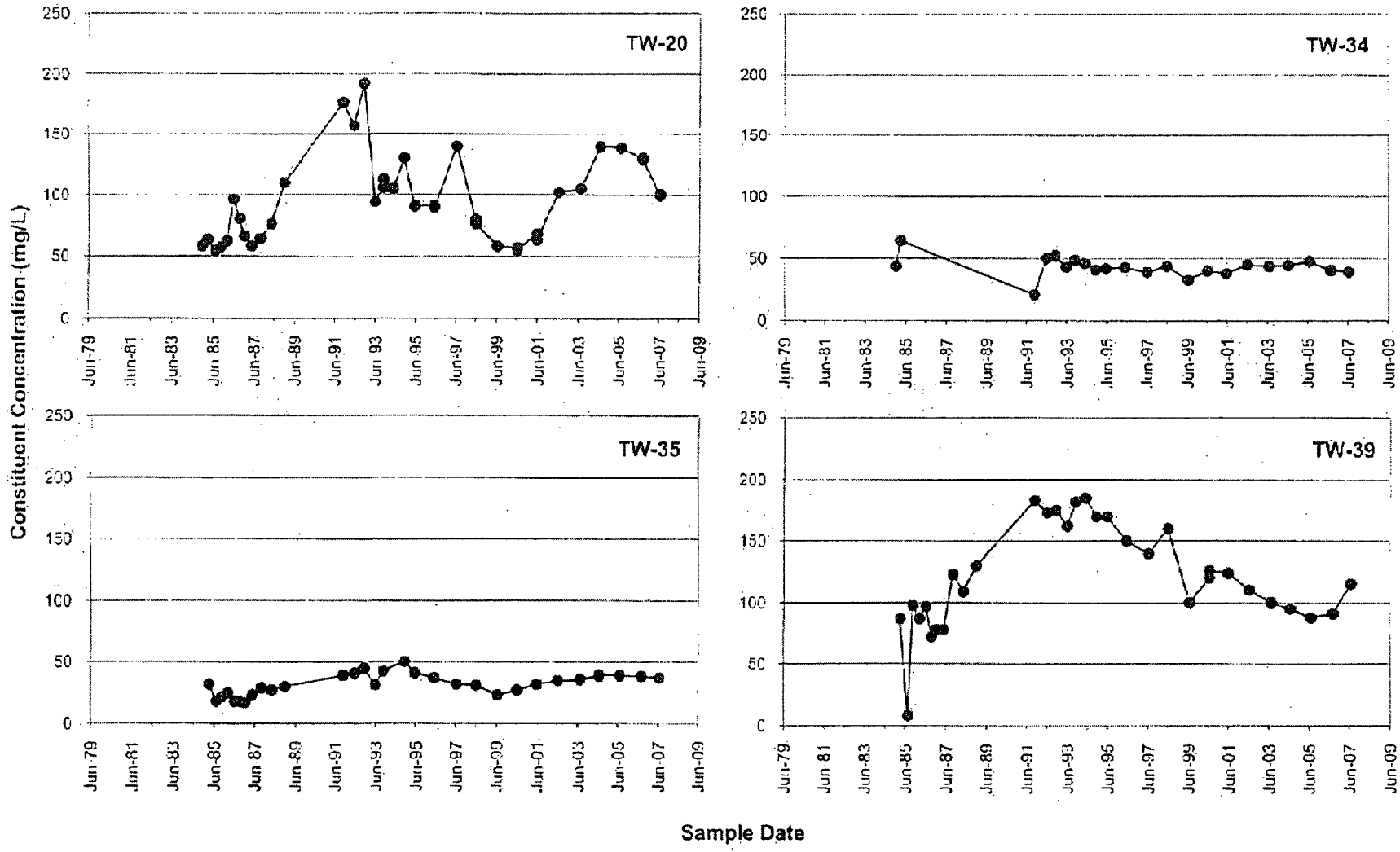
TITLE

Chloride in Production Wells

FIGURE F-1

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	D-
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101 605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

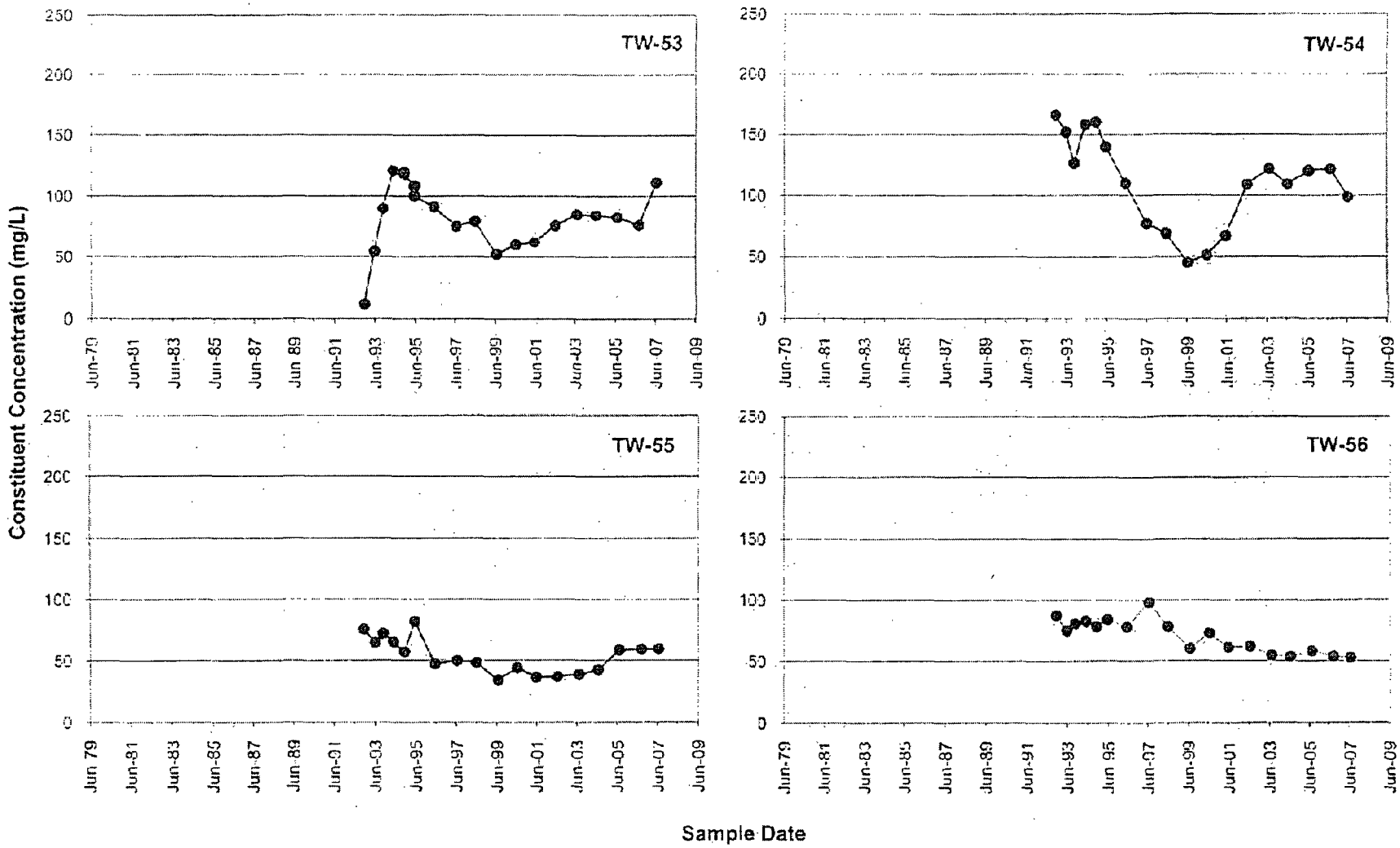
TITLE

Chloride in South Fenceline Wells

FIGURE F-2

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

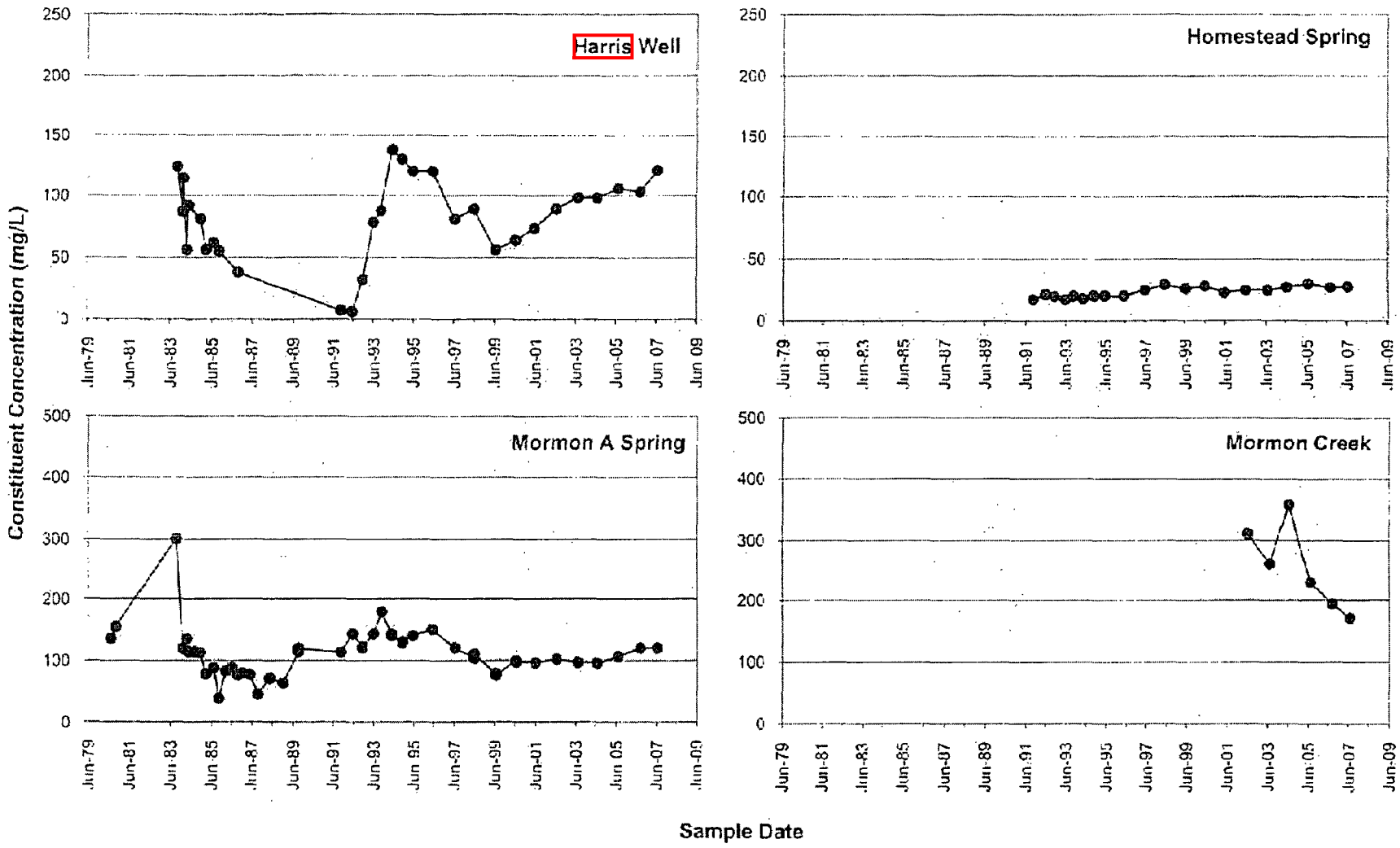
TITLE **Chloride in Southern Boundary Wells**

Constituent Concentration (mg/L)

CLIENT	Monsanto Company		
PROJECT	Monsanto Groundwater Monitoring		
PROJECT NO	913-1101.605A	DATE	29-Nov-07

FIGURE **F-3**

DRAWN	DH
CHECKED	MPK
REVIEWED	DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

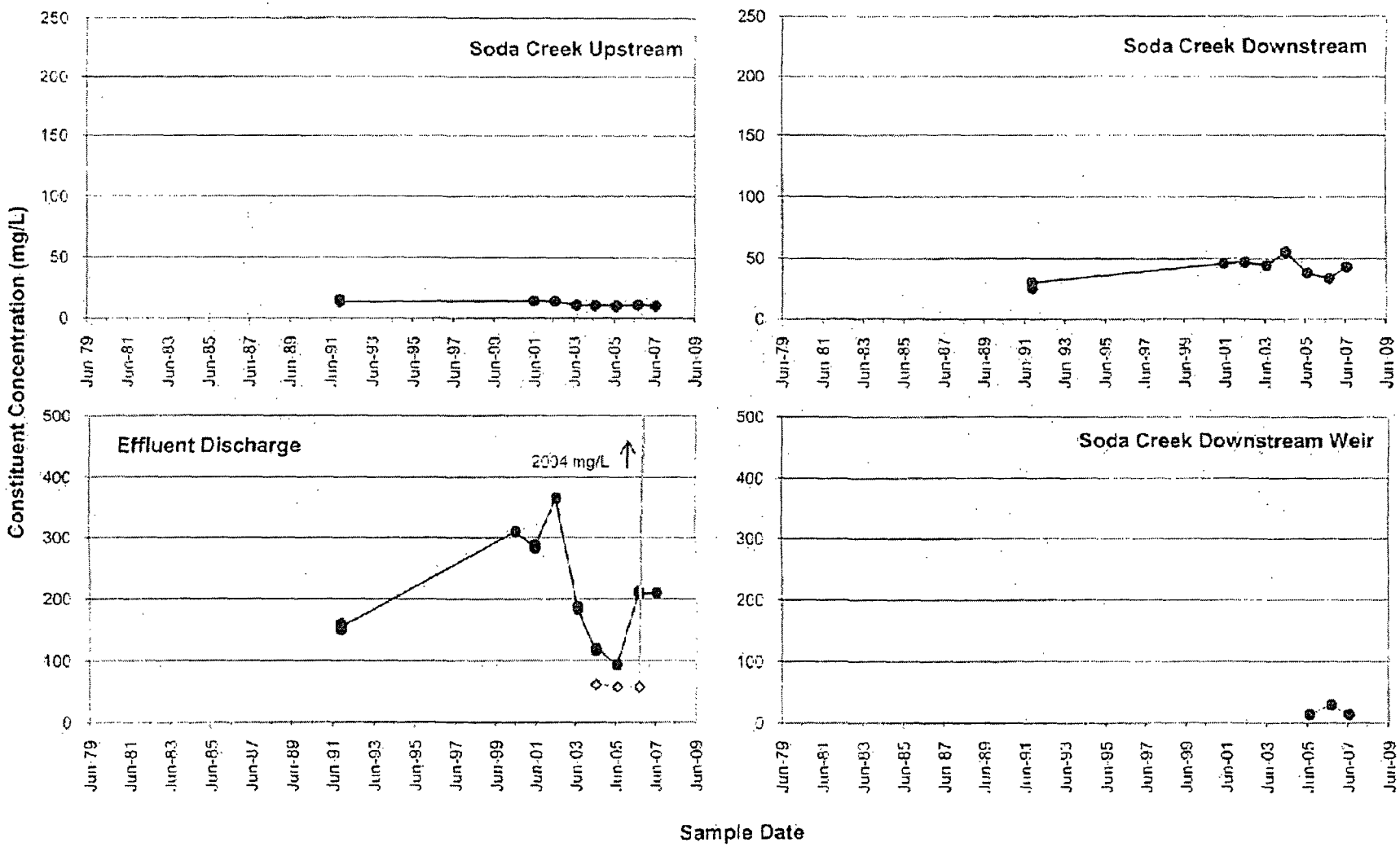
Golder Associates

TITLE Chloride in Harris Well and Springs South of Plant

FIGURE F-4

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME Apr F Chloride Charts 2007 xls

Remediation goals shown for point of compliance locations only

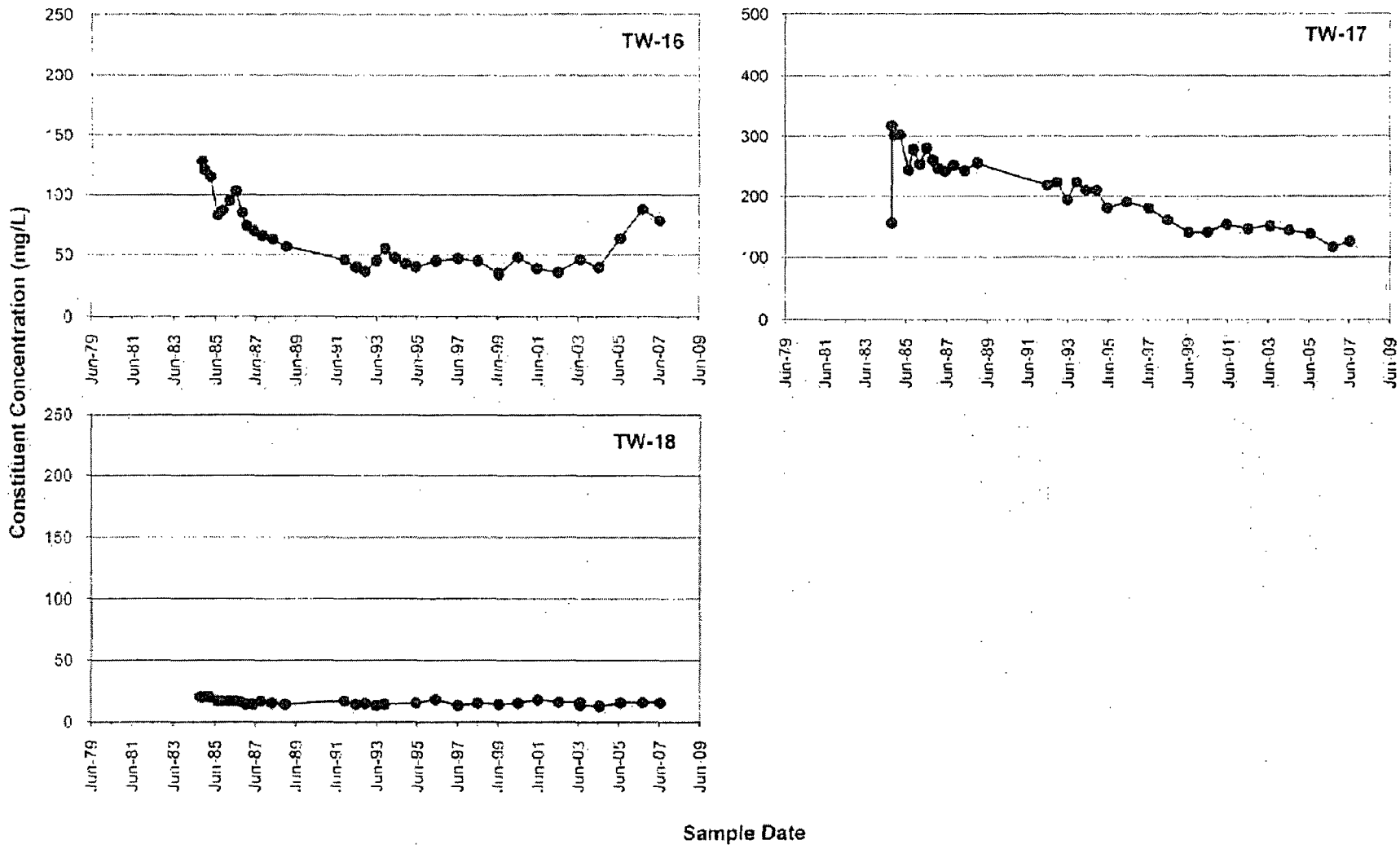
Golder Associates

TITLE **Chloride in Soda Creek and Treatment Plant Effluent**

FIGURE F-5

Constituent Concentration (mg/L) ◇ Pond Inlet

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

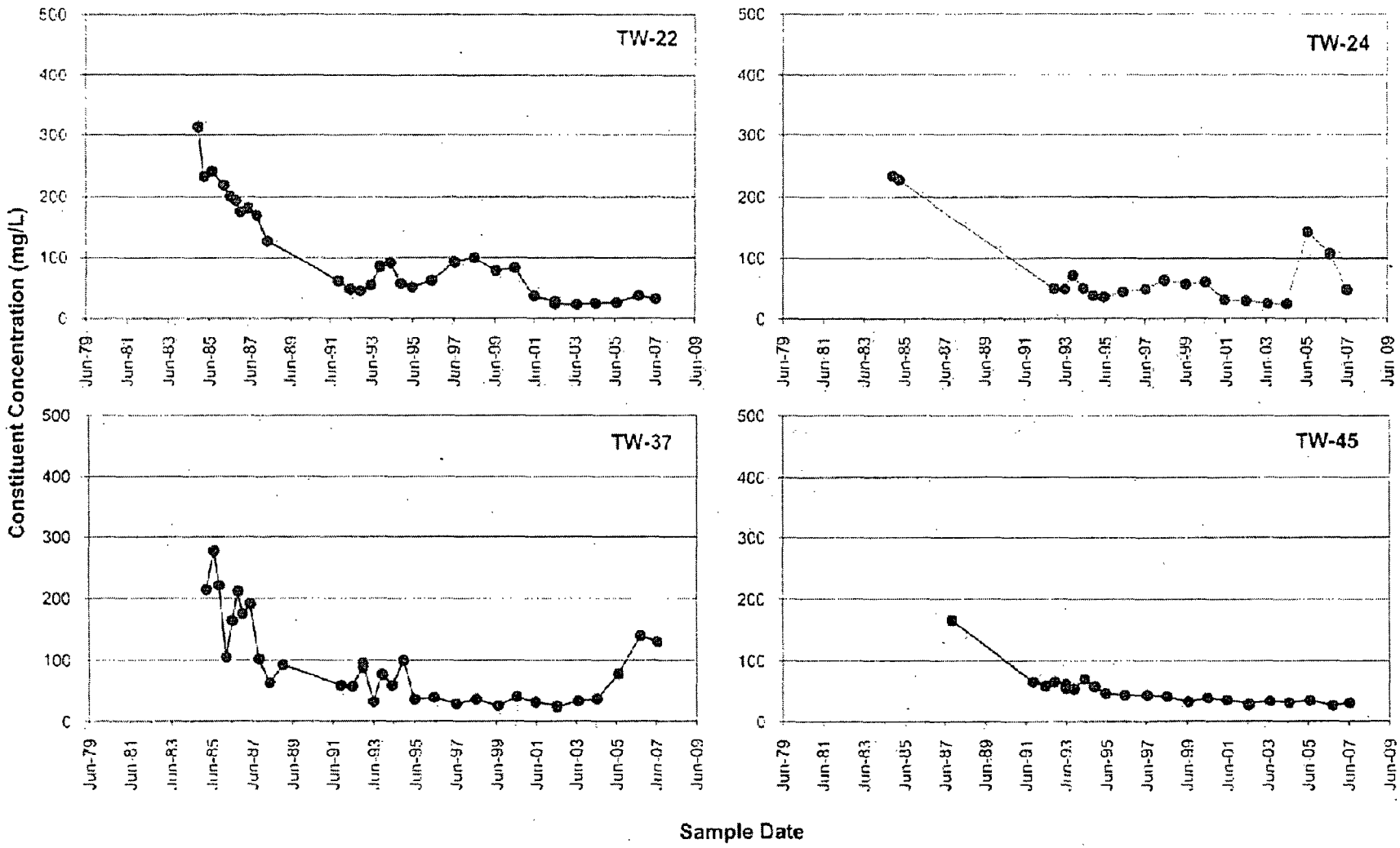
Golder Associates

TITLE **Chloride in NW Pond Wells**

FIGURE F-6

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

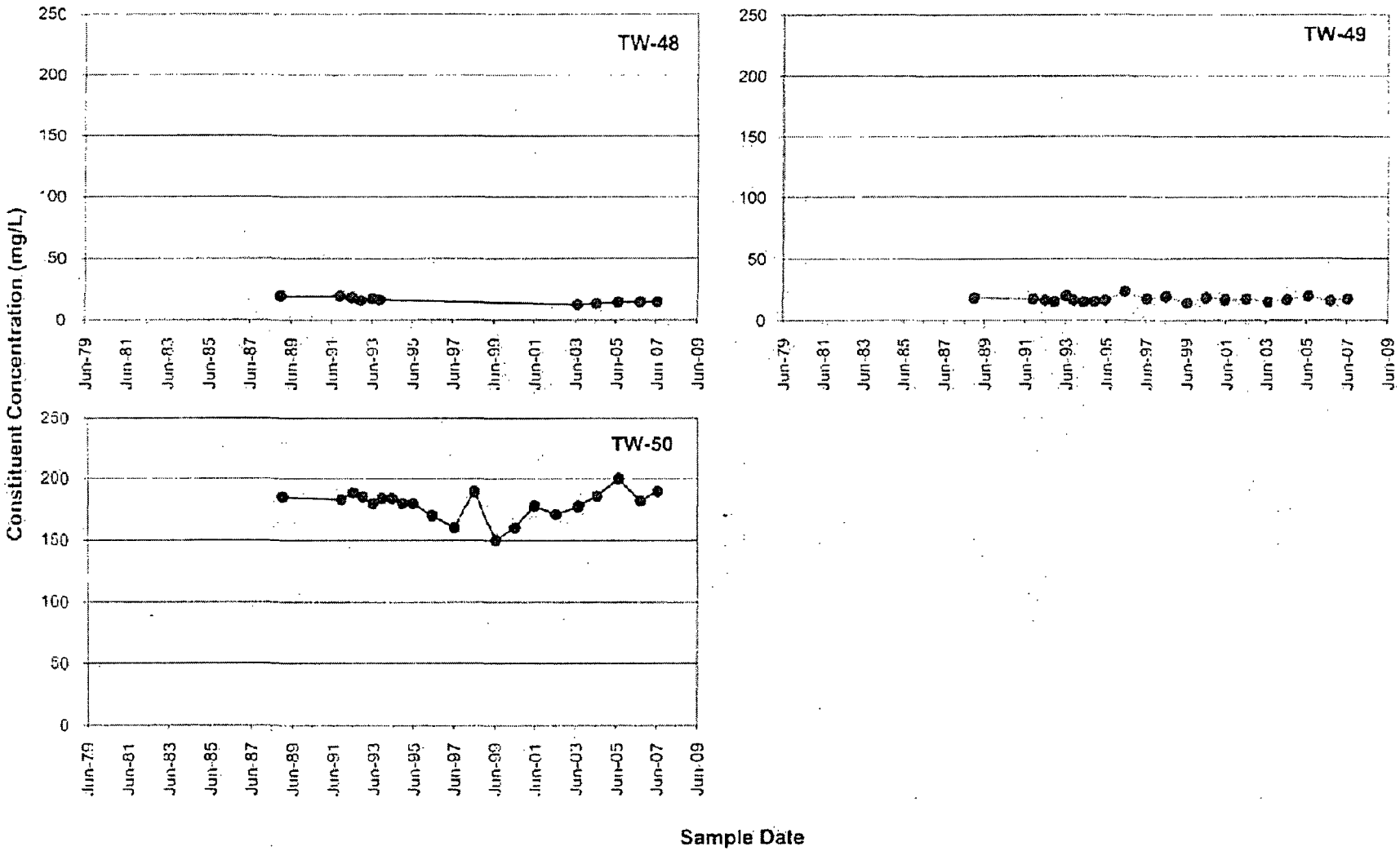
Golder Associates

TITLE **Chloride in Old Underflow Solids Pond Area Wells**

FIGURE **F-7**

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

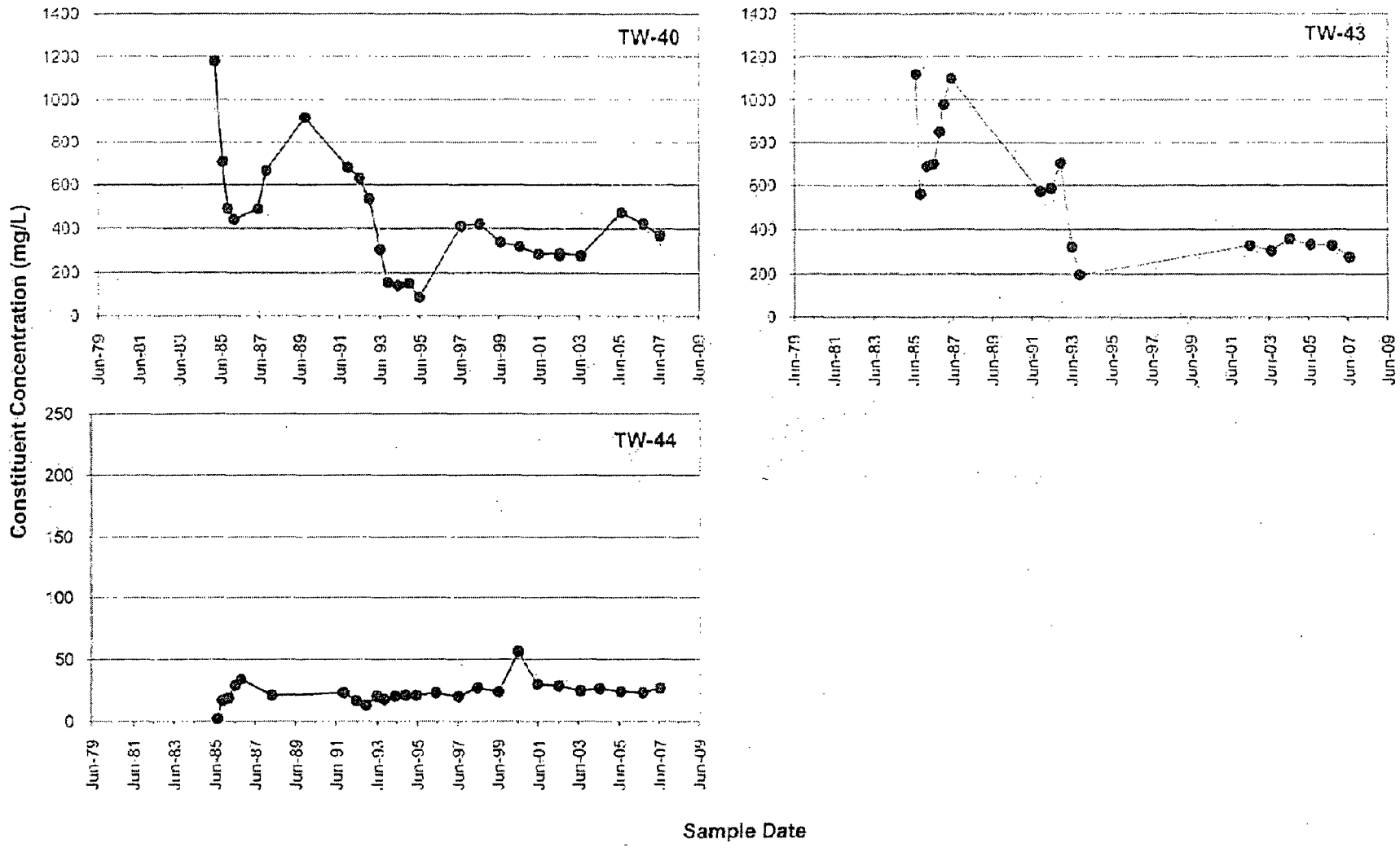
Golder Associates

TITLE **Chloride in Underflow Solids Piles Area Wells**

FIGURE F-8

—●— Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME Acp F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

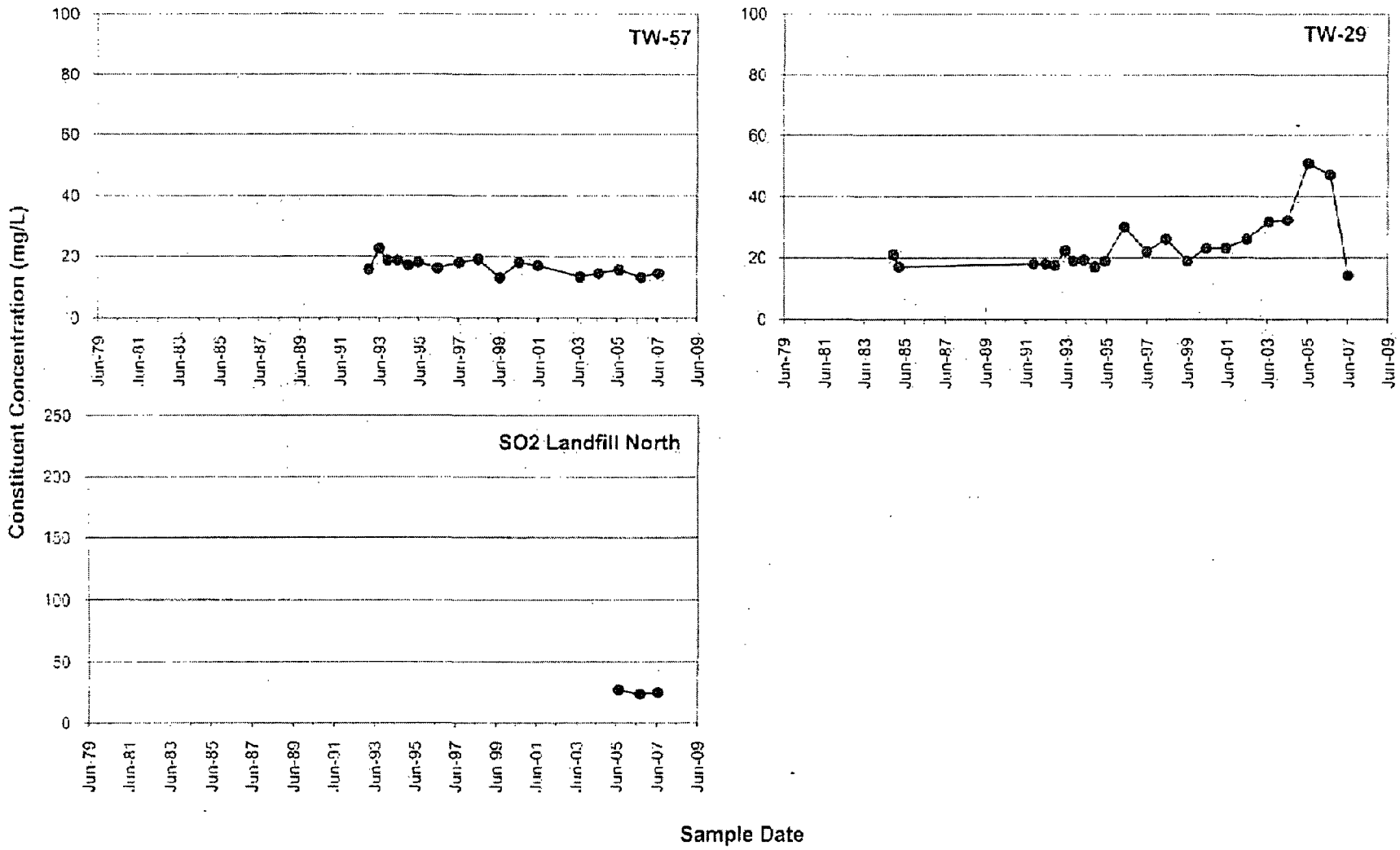
TITLE

Chloride in Hydroclarifier Area Wells

FIGURE F-9

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

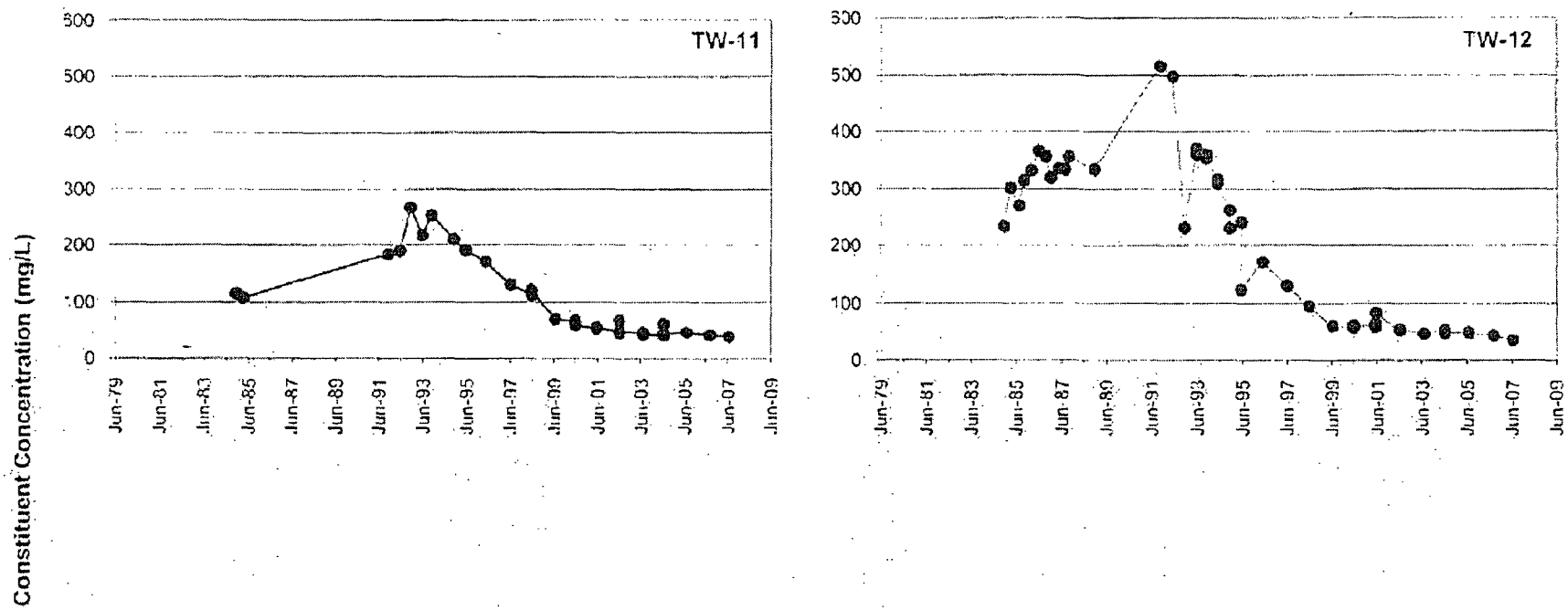
Golder Associates

TITLE **Chloride in Background Wells**

FIGURE **F-10**

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



Sample Date

FILE NAME Acp F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

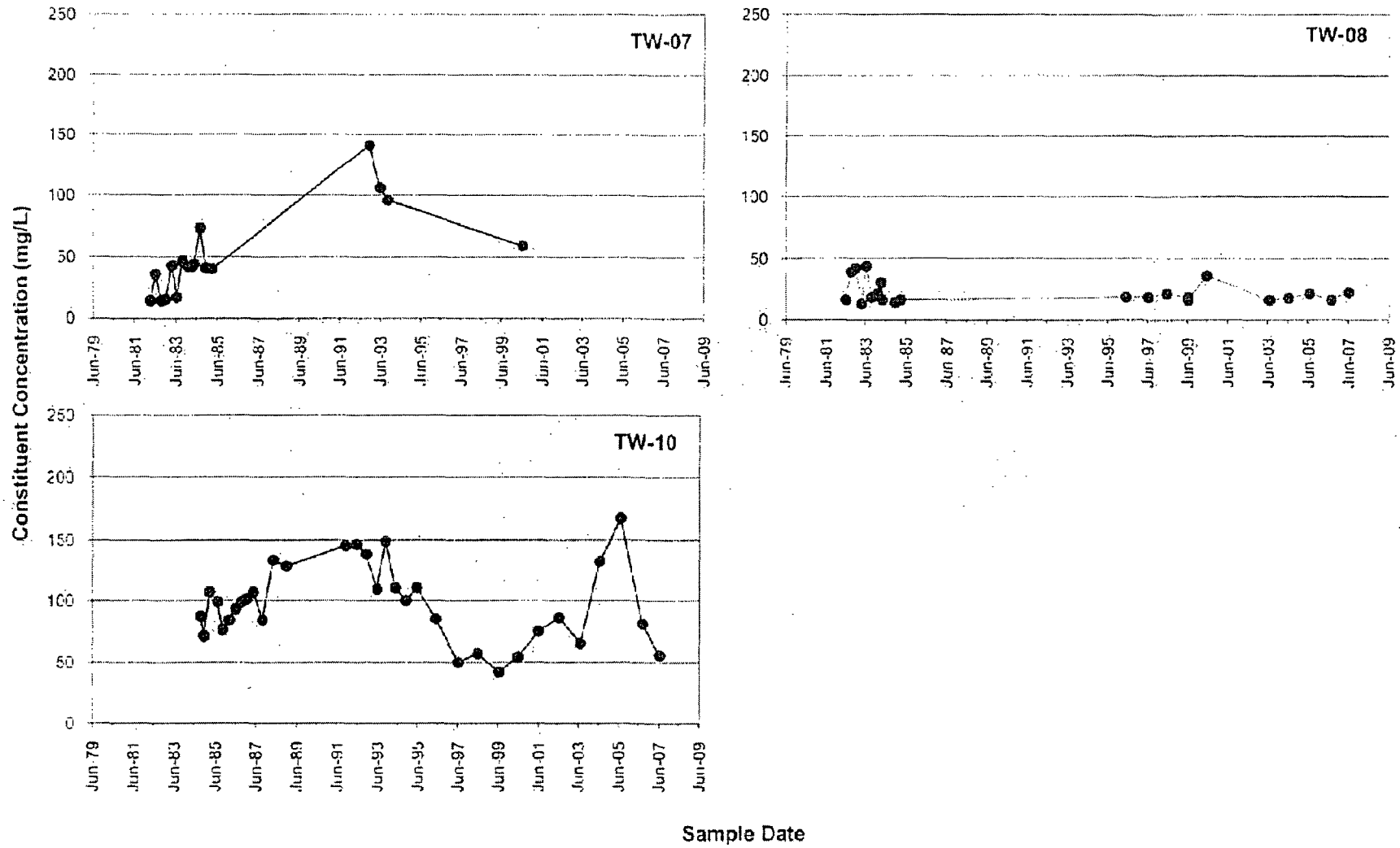
Golder Associates

TITLE **Chloride in Southeast Corner Wells**

FIGURE F-11

—●— Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

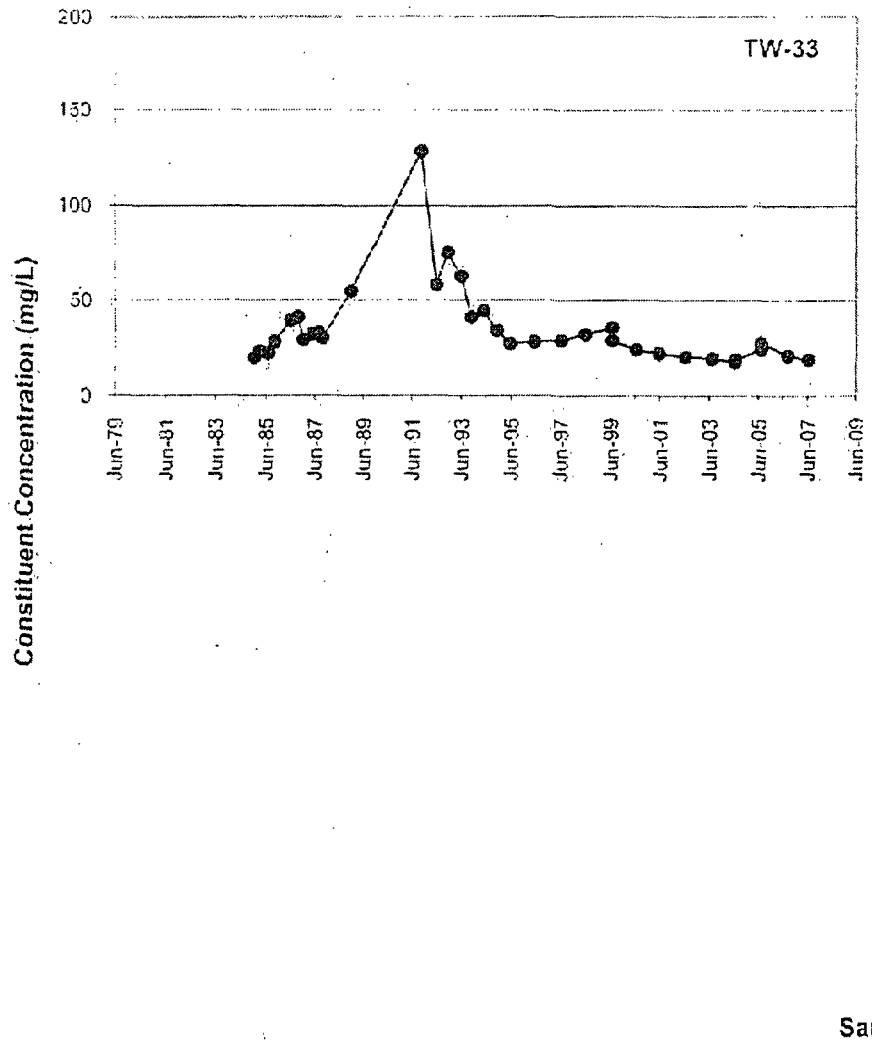
TITLE

Chloride in Southwest Corner Wells

FIGURE F-12

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



FILE NAME App F Chlor de Charts 2007.ds

Remediation goals shown for point of compliance locations only

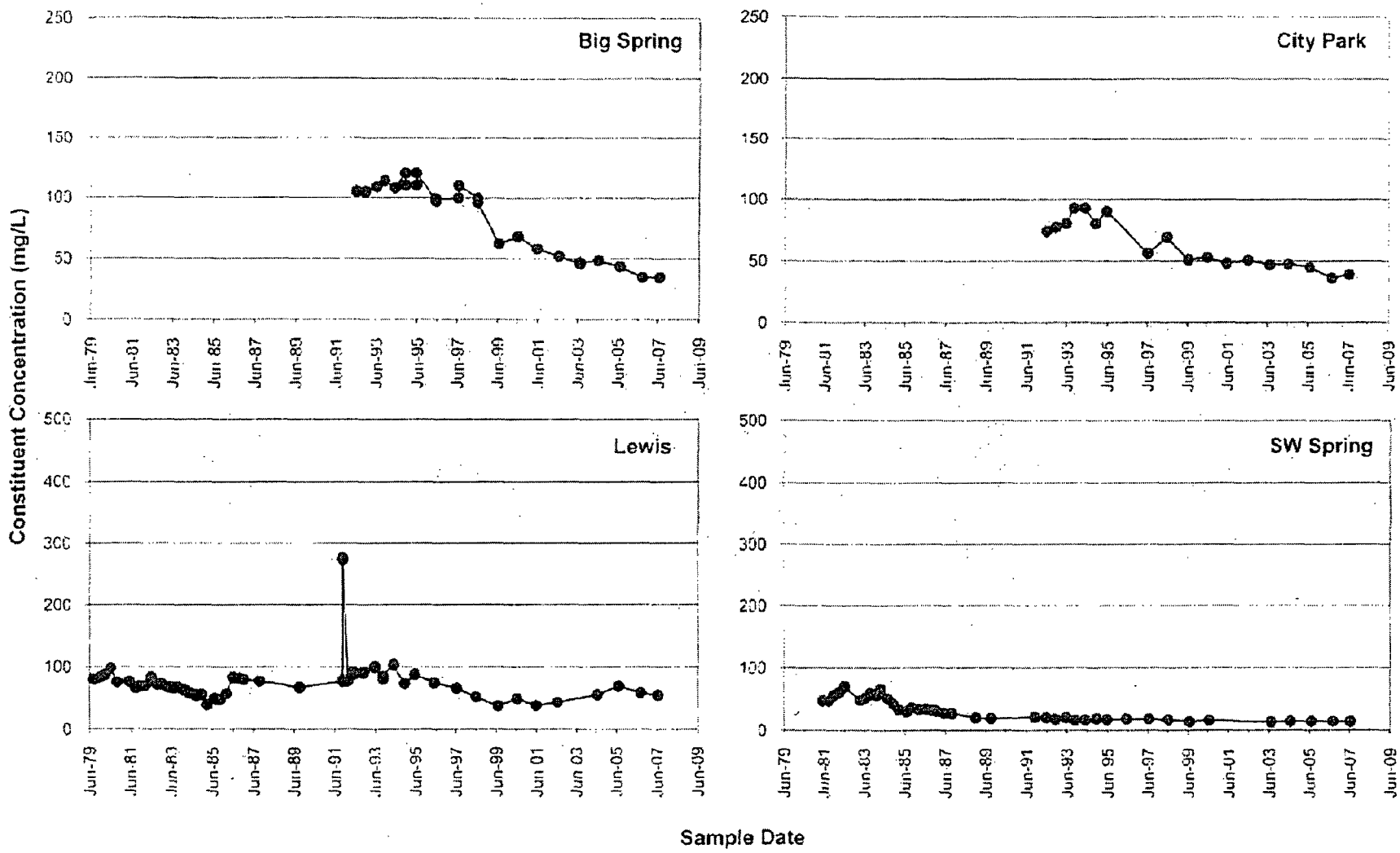
Golder Associates

TITLE **Chloride in East Area Wells**

FIGURE **F-13**

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

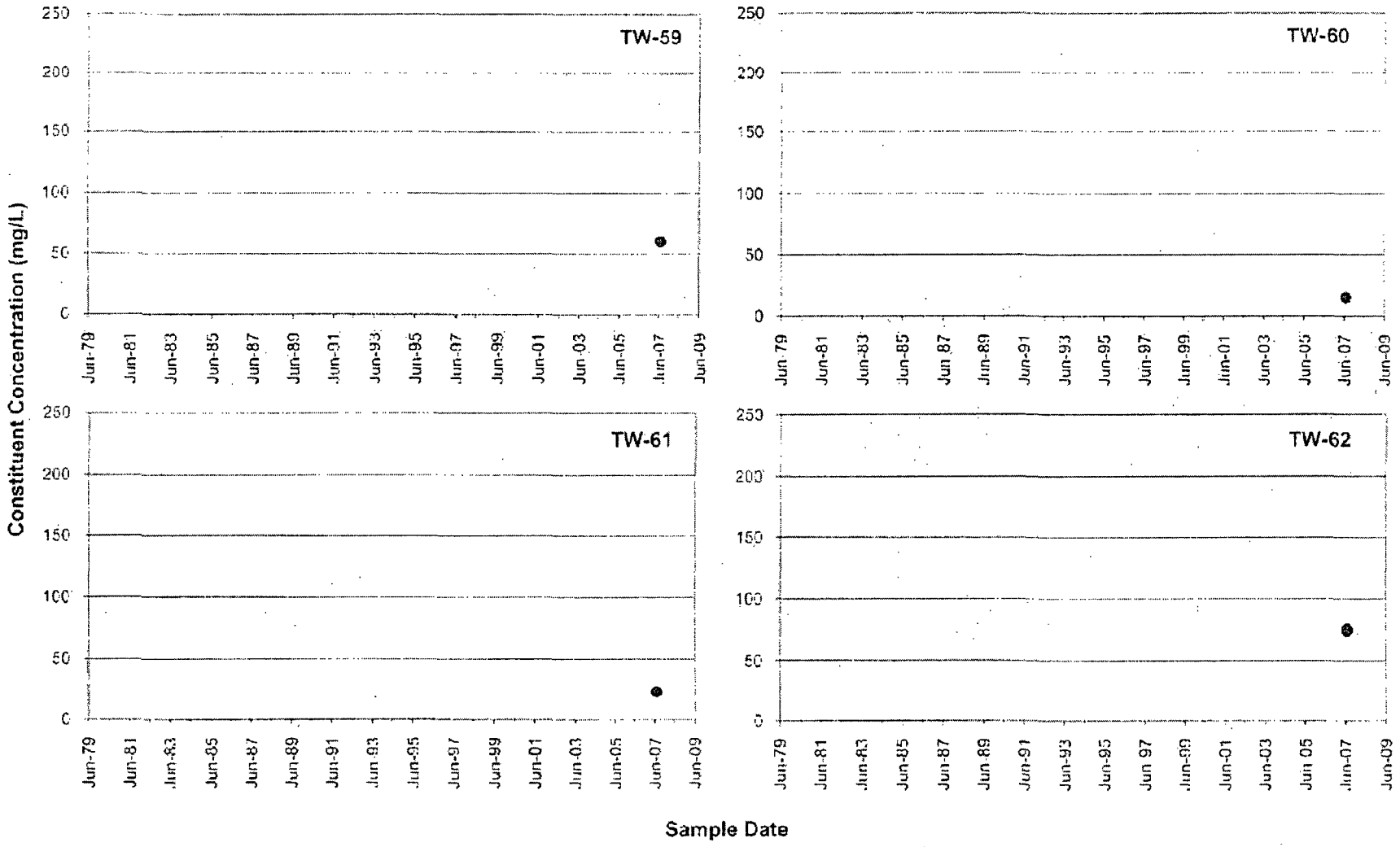
Golder Associates

TITLE **Chloride in Offsite Wells and Springs**

FIGURE F-14

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App F Chloride Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Chloride in 2007 Monitoring Wells**

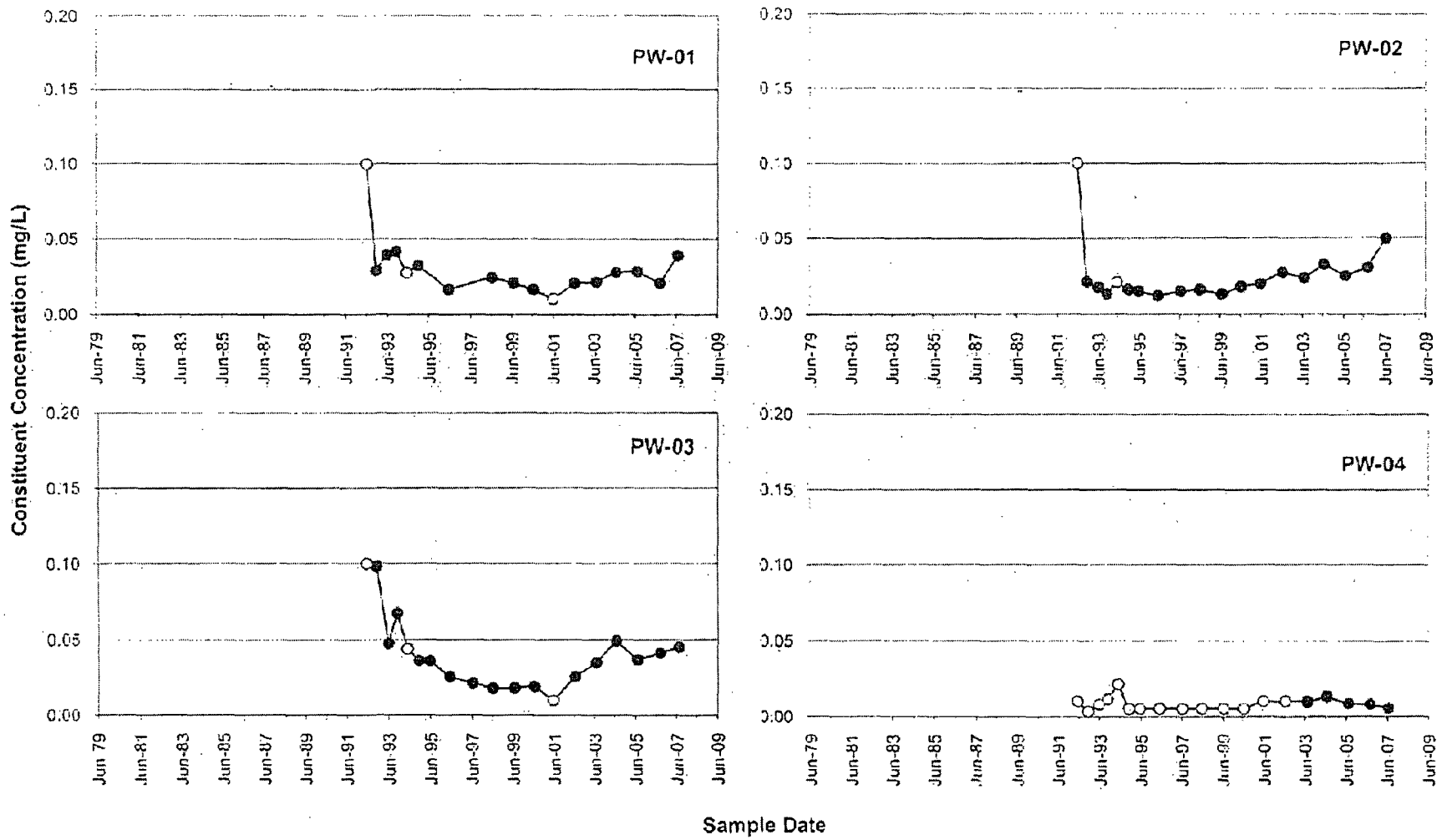
FIGURE F-15

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB

APPENDIX G

TIME-HISTORY GRAPHS FOR MOLYBDENUM



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

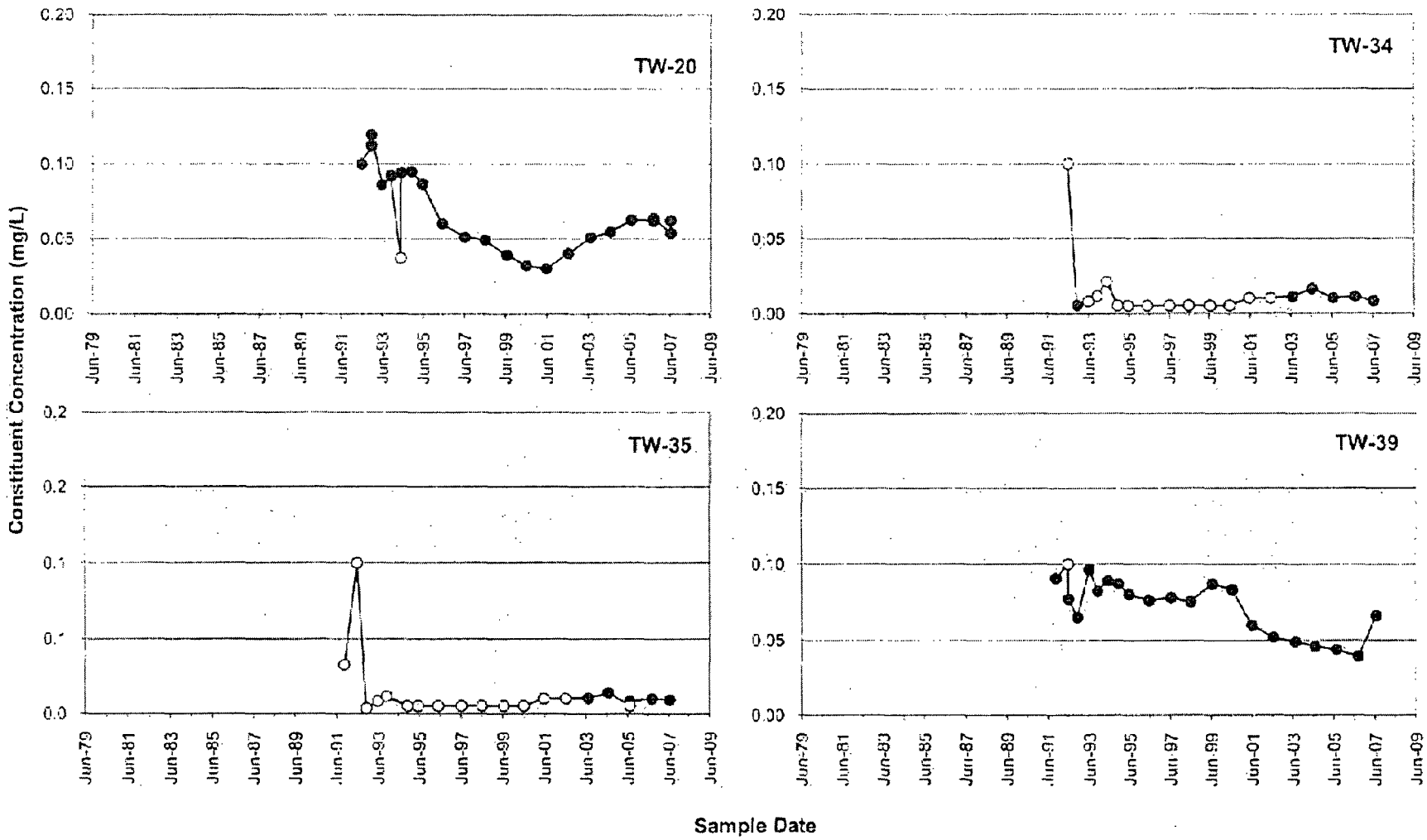
TITLE **Molybdenum in Production Wells**

FIGURE G-1

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

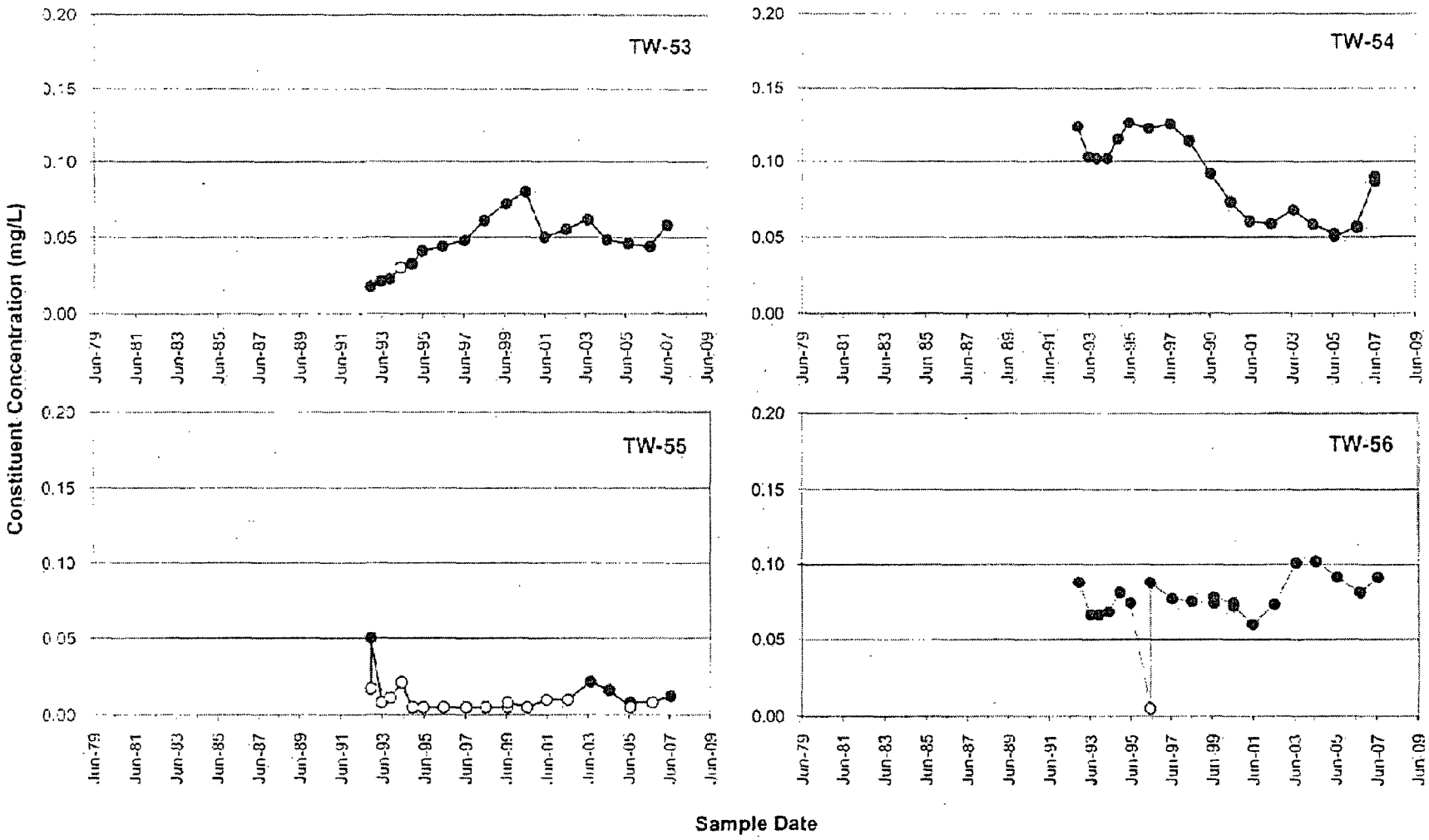
TITLE **Molybdenum in South Fenceline Wells**

FIGURE G-2

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

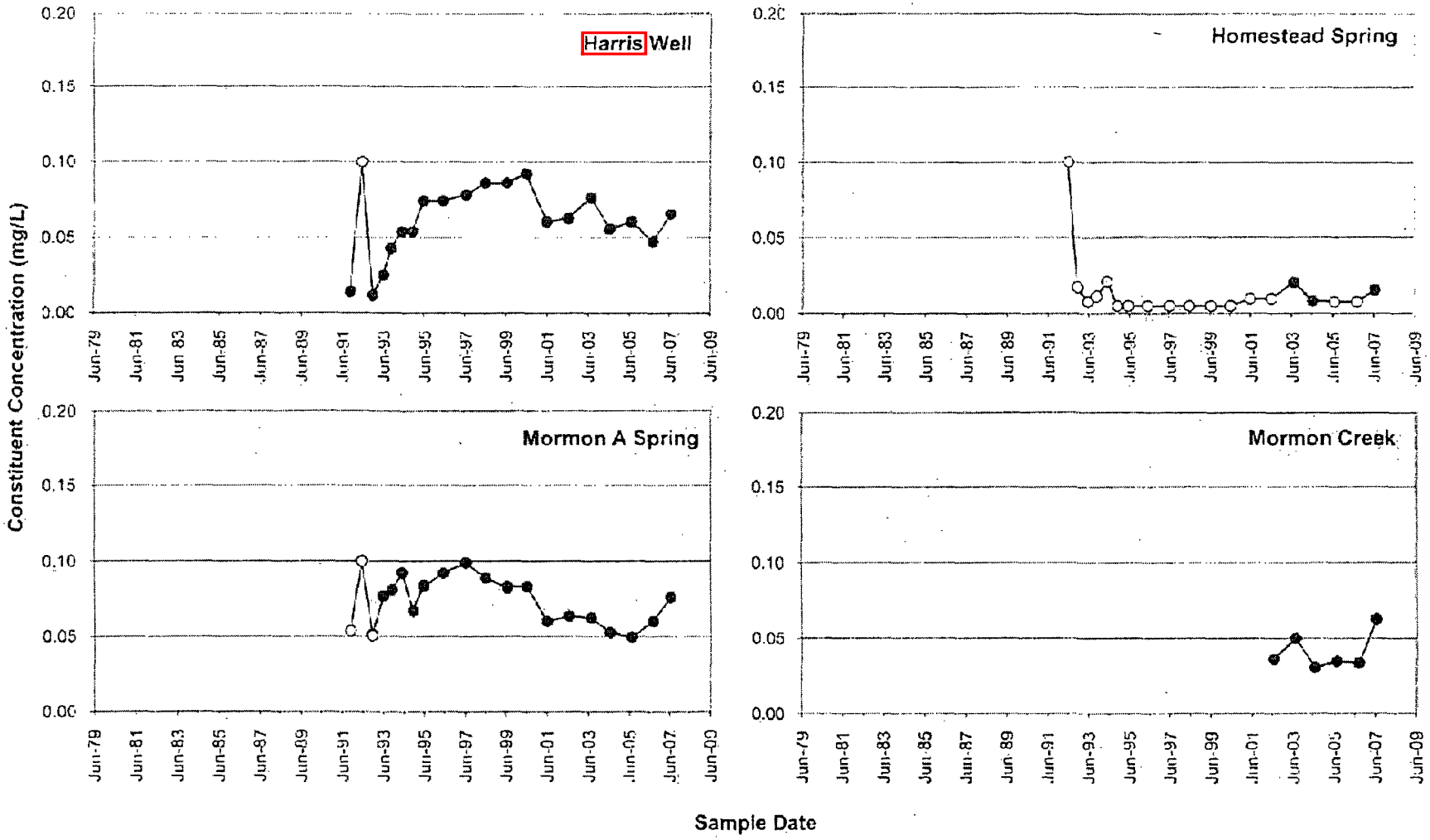
TITLE: Molybdenum in Southern Boundary Wells

FIGURE G-3

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

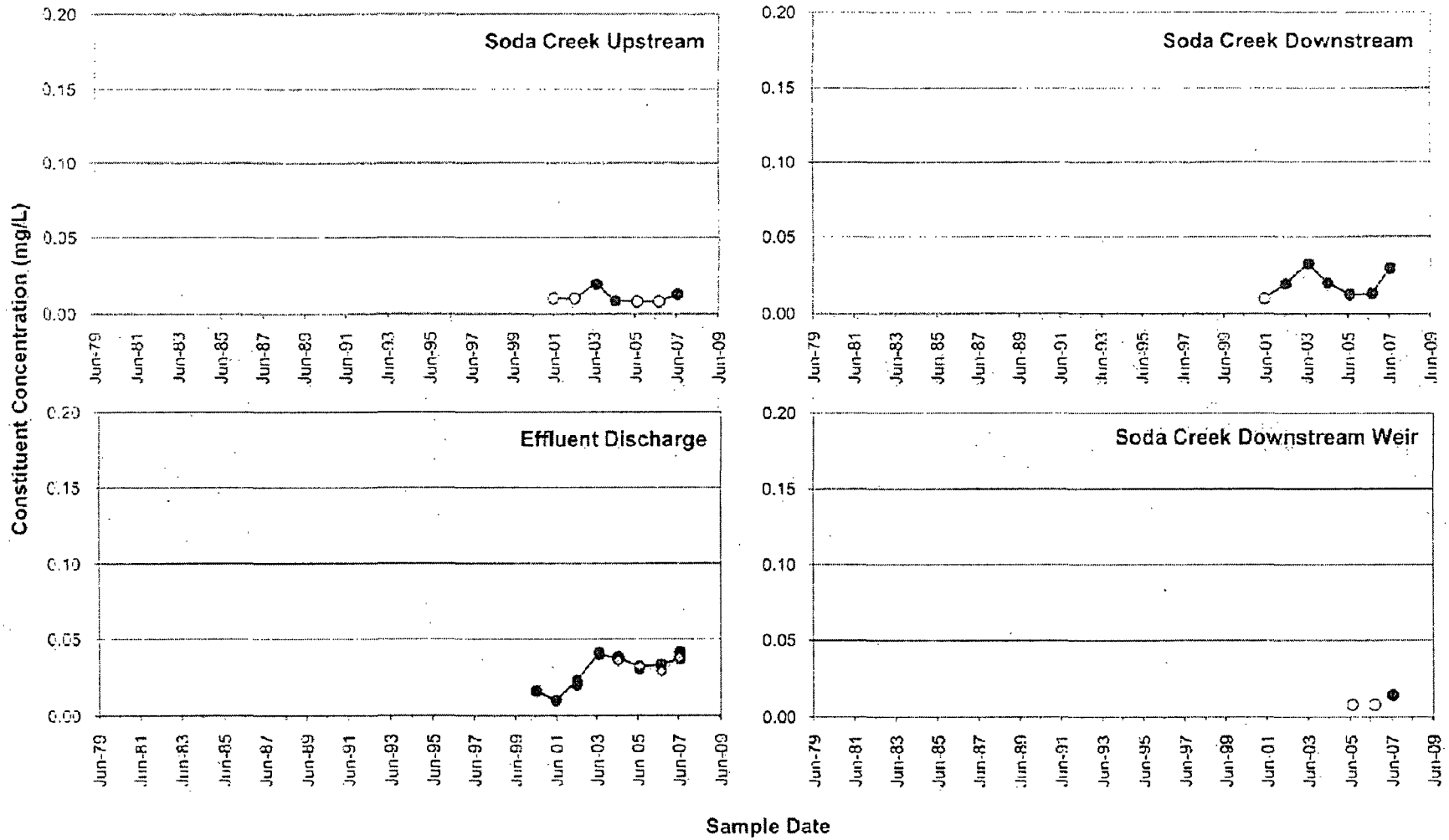
TITLE **Molybdenum in Harris Well and Springs South of Plant**

FIGURE G-4

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

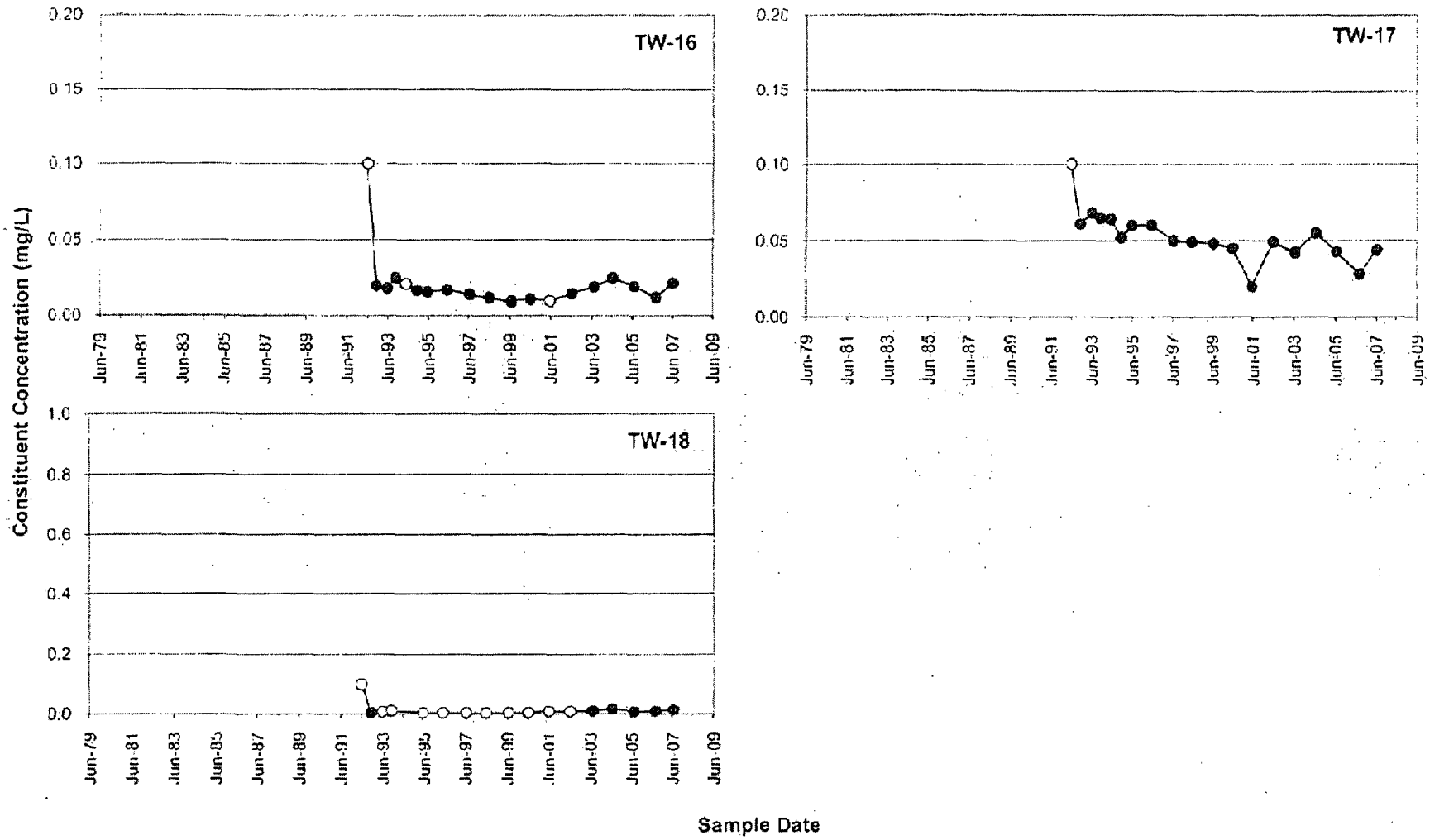
Golder Associates

TITLE **Molybdenum in Soda Creek and Treatment Plant Effluent**

FIGURE G-5

Constituent Concentration (mg/L)
Non-Detects
Pond Inlet

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



Remediation goals shown for point of compliance locations only

FILE NAME App G Molybdenum Charts 2007.xls

Golder Associates

TITLE

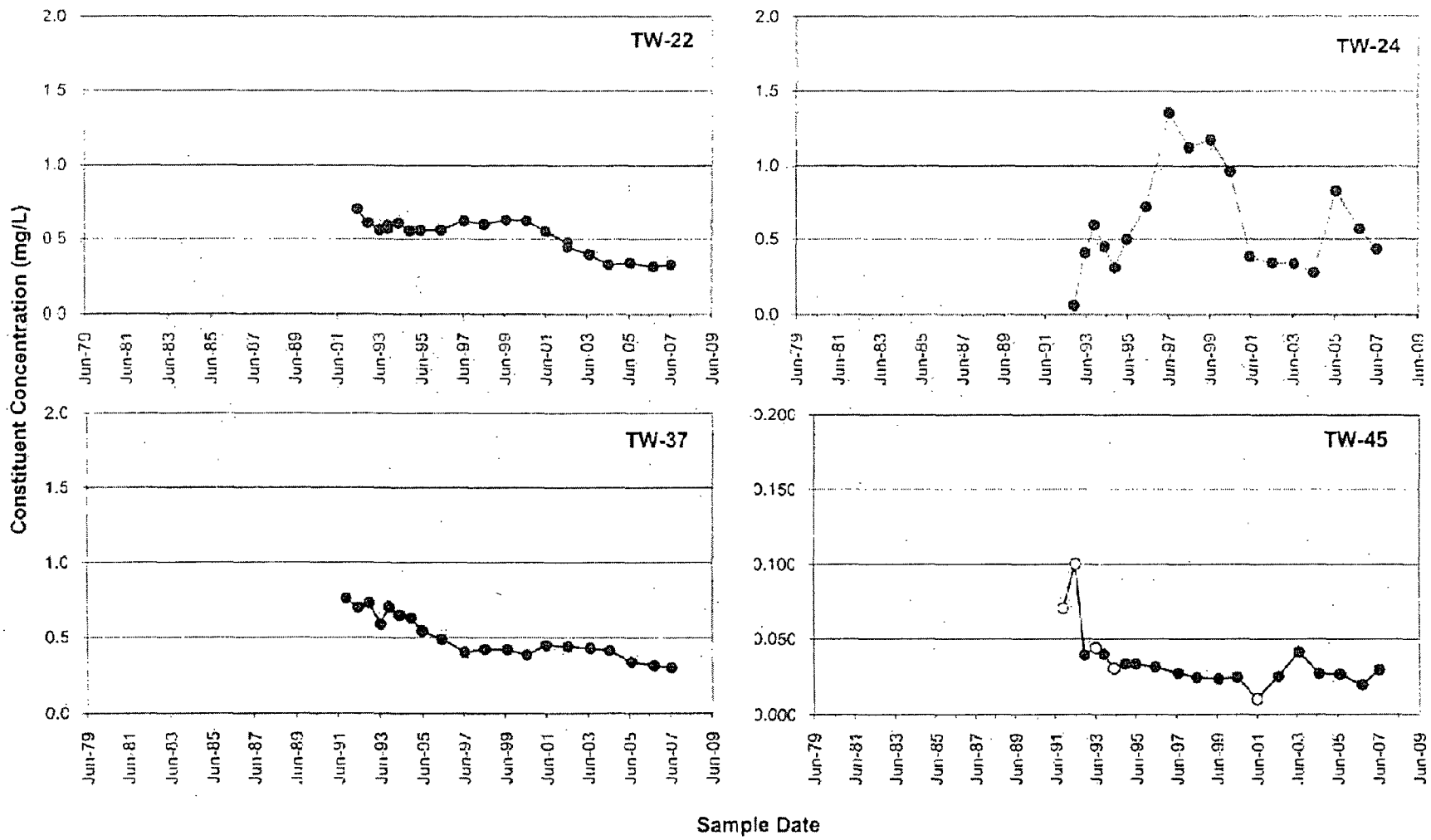
Molybdenum in NW Pond Wells

FIGURE G-6

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED	DB



FILE NAME Acp G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

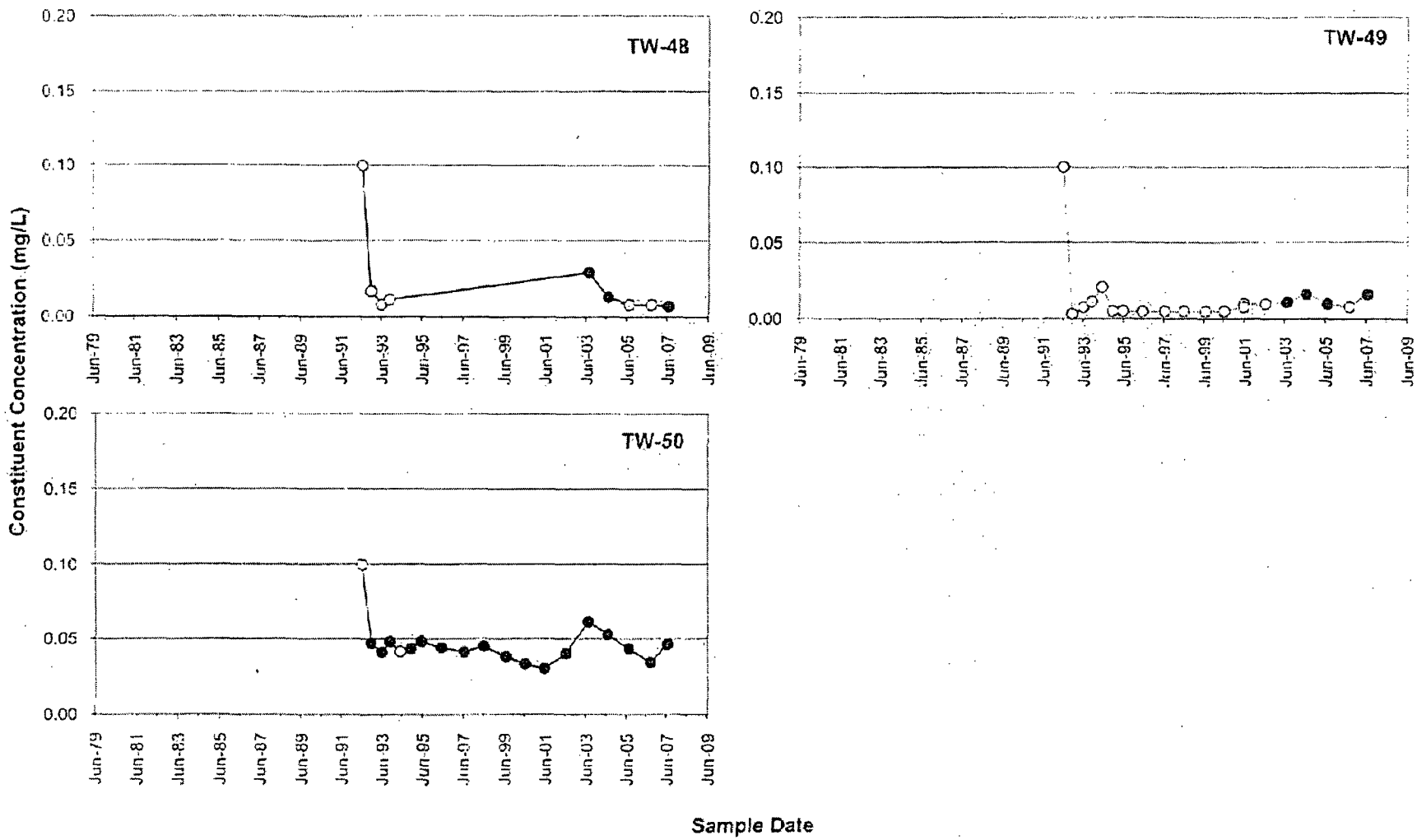
Golder Associates

TITLE **Molybdenum in Old Underflow Solids Pond Area Wells**

FIGURE G-7

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.505A	DATE 29-Nov-07	REVIEWED DS



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

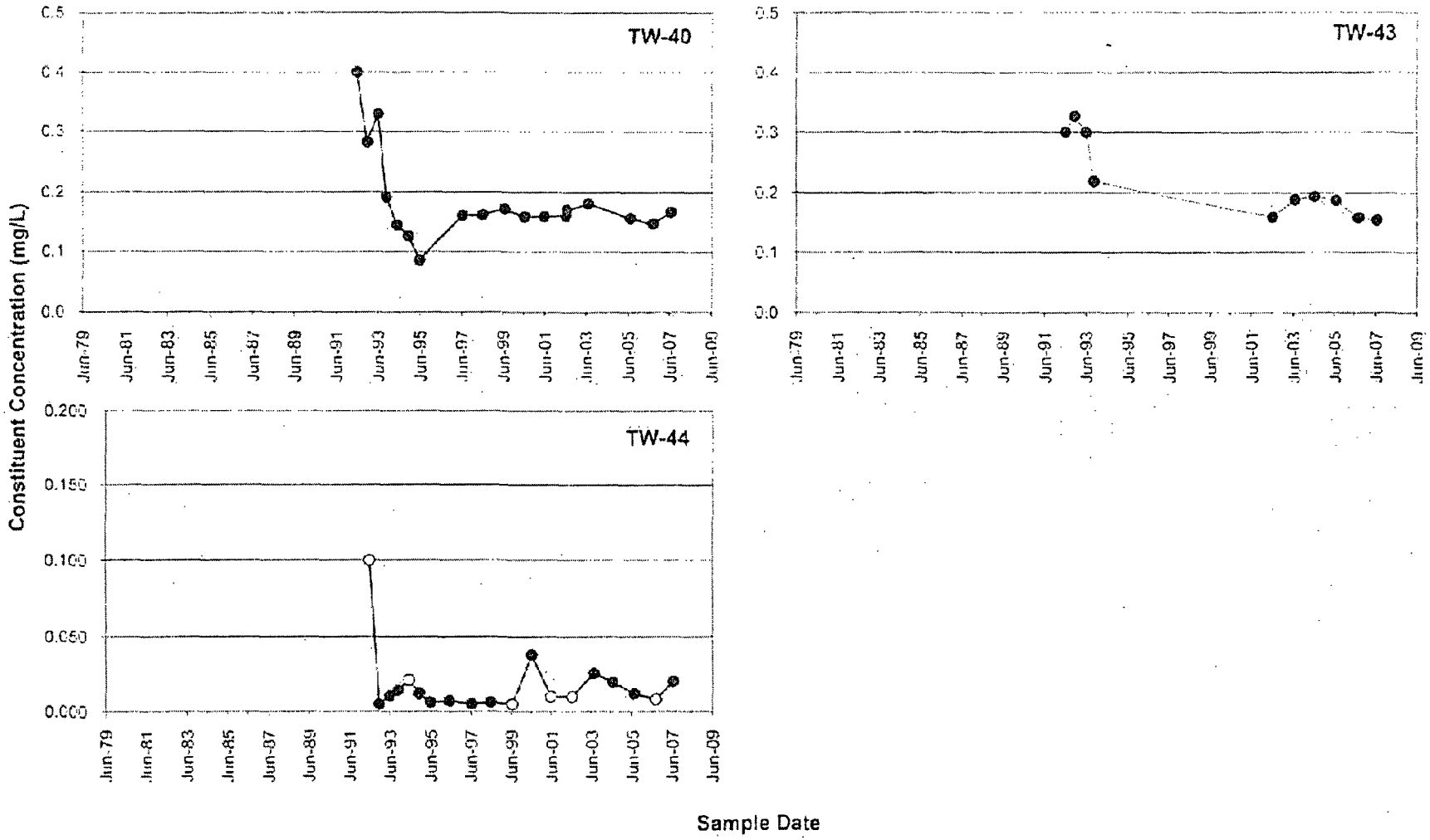
TITLE **Molybdenum in Underflow Solids Piles Area Wells**

FIGURE G-8

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101 605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

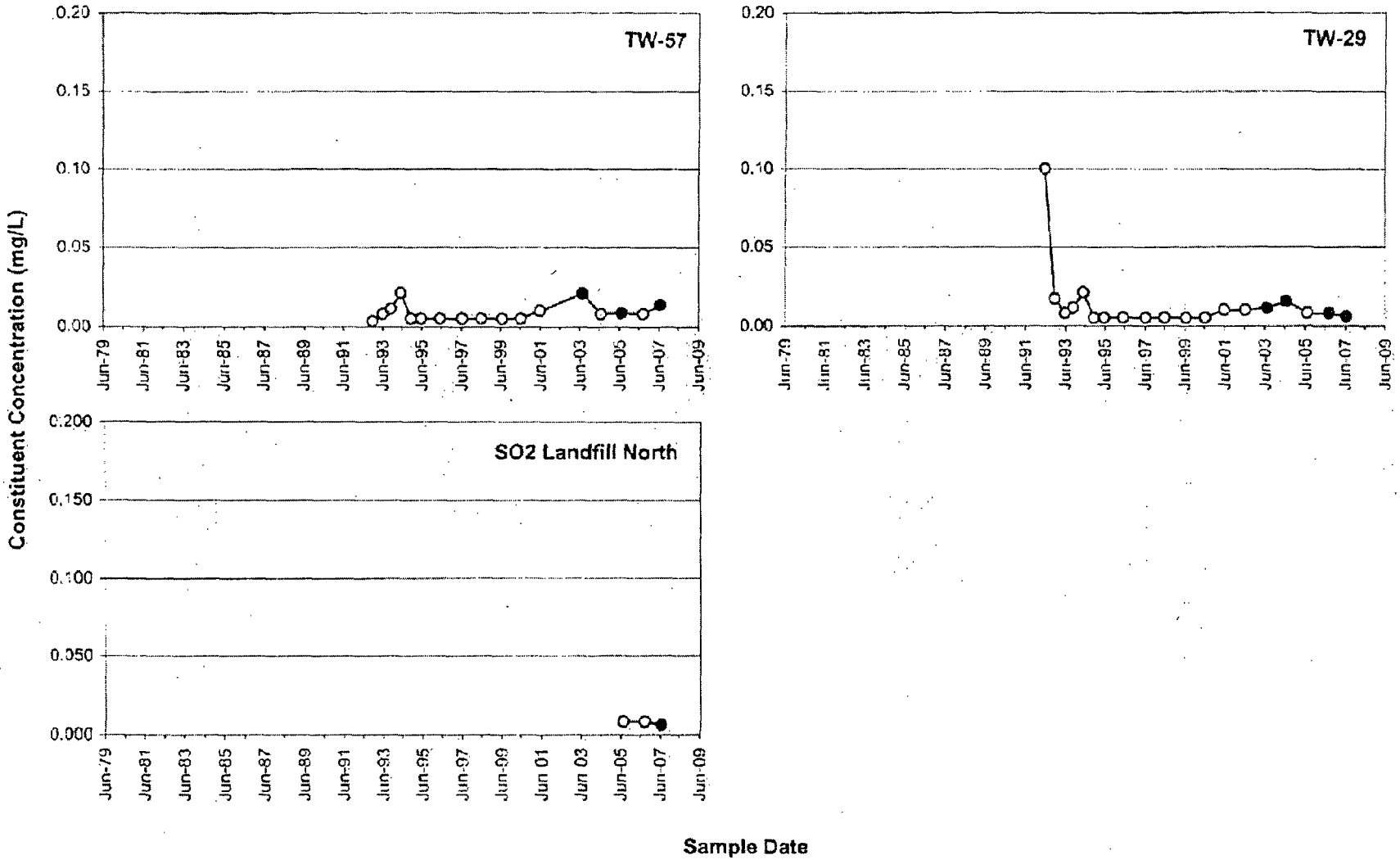
TITLE **Molybdenum in Hydroclarifier Area Wells**

FIGURE **G-9**

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

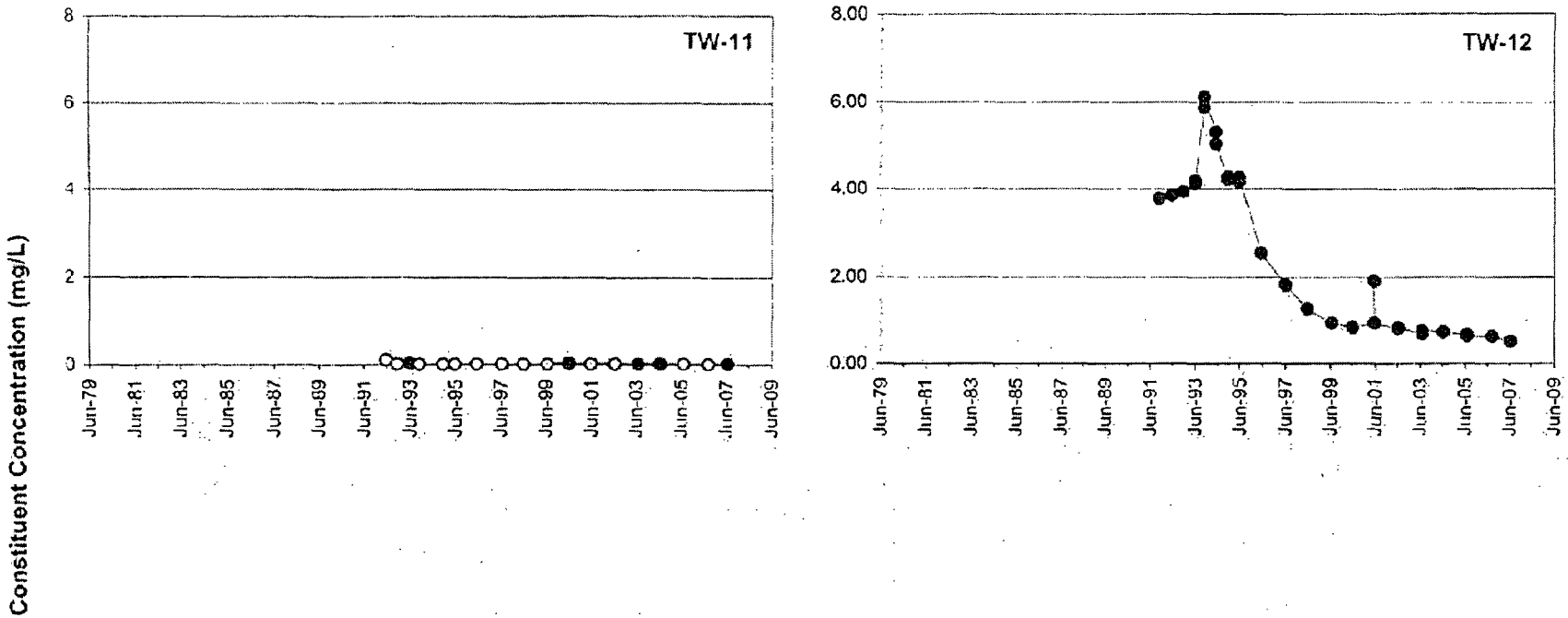
TITLE **Molybdenum in Background Wells**

FIGURE G-10

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



Sample Date

FILE NAME Apc G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

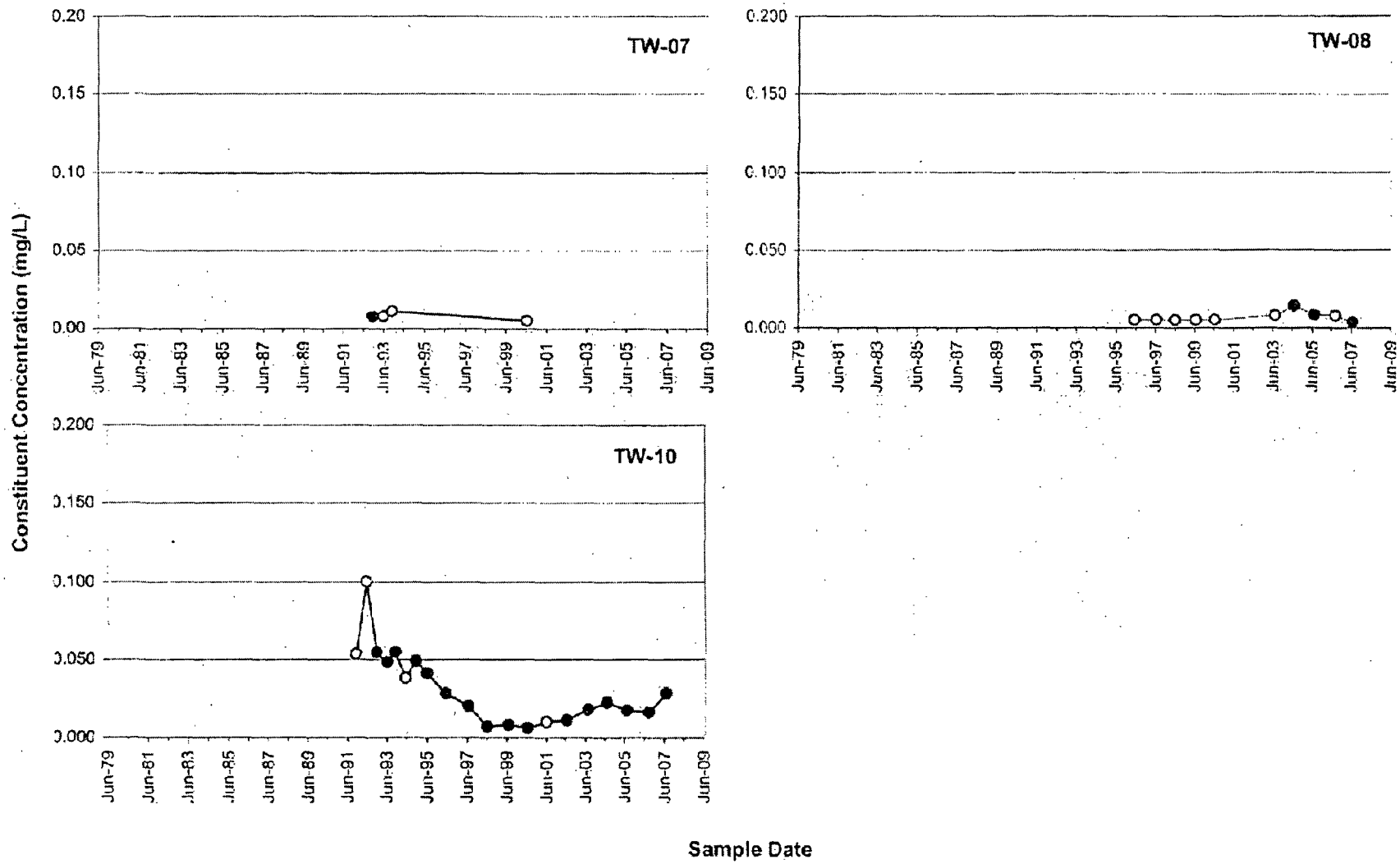
TITLE **Molybdenum in Southeast Corner Wells**

FIGURE G-11

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

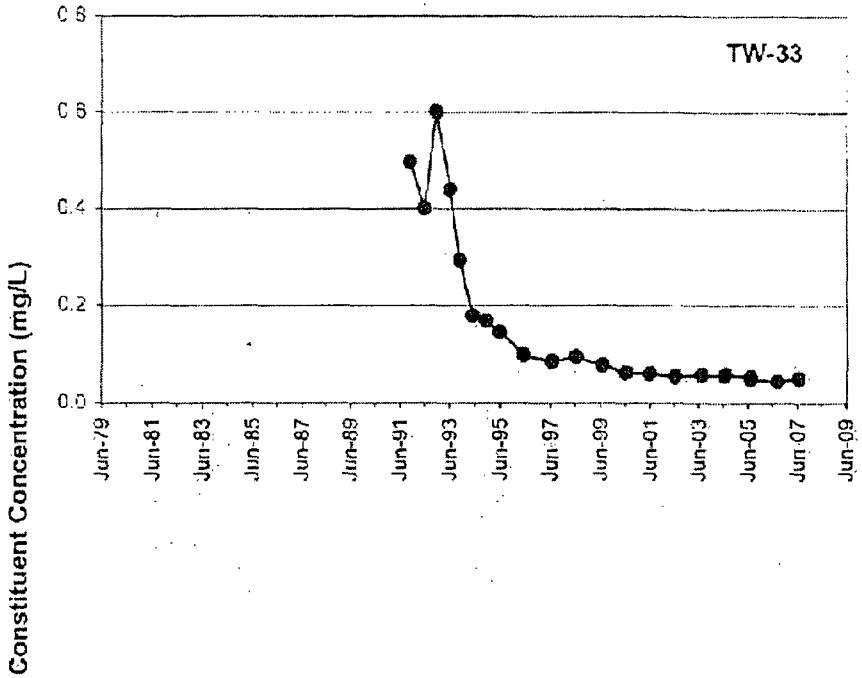
TITLE **Molybdenum in Southwest Corner Wells**

FIGURE G-12

—●— Constituent Concentration (mg/L)

○ Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB

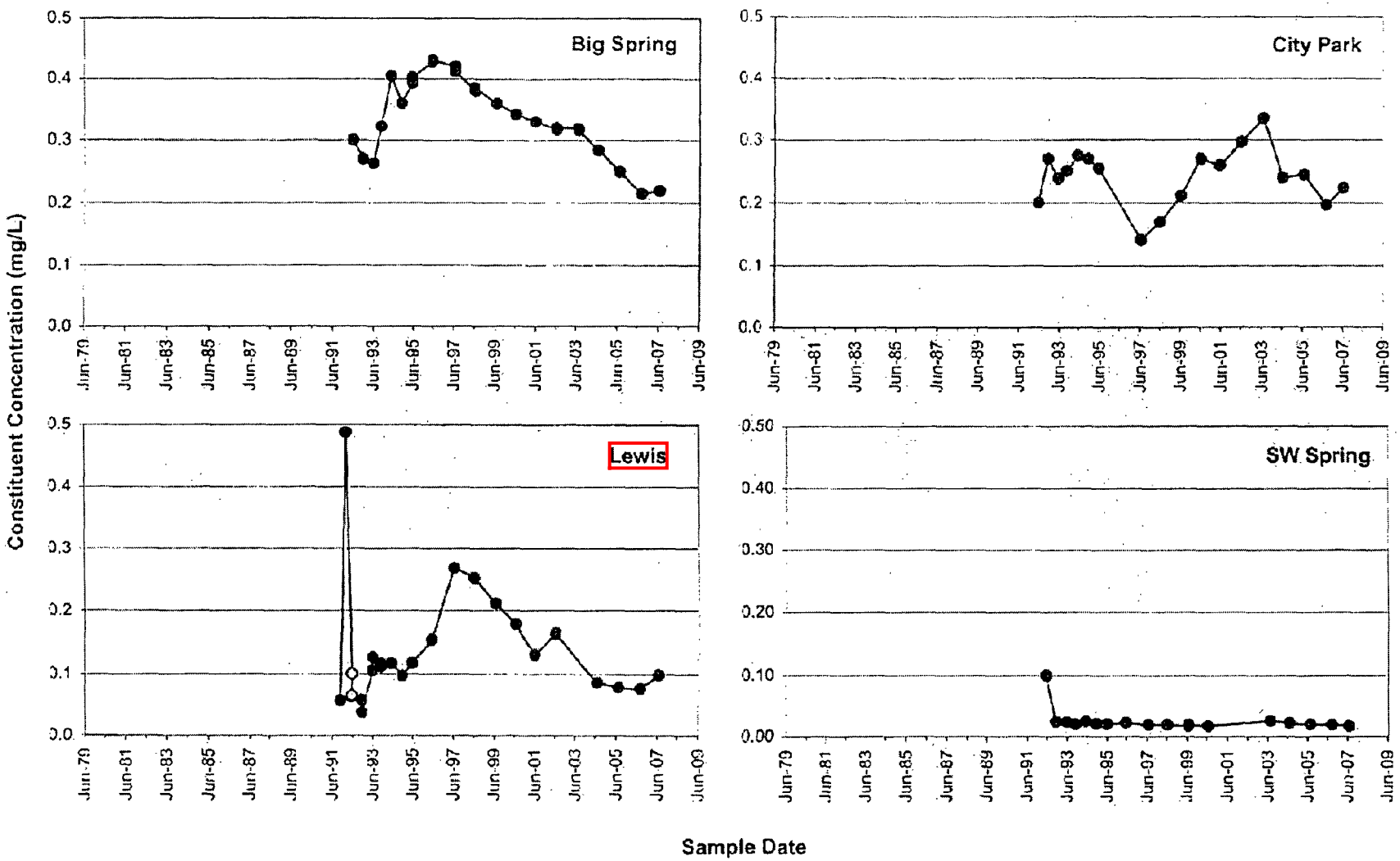


Sample Date

FILE NAME App G Molybdenum Charts 2007 x s

Remediation goals shown for point of compliance locations only

Golder Associates	TITLE Molybdenum in East Wells		FIGURE G-13
—●— Constituent Concentration (mg/L)	CLIENT Monsanto Company		DRAWN DH
	PROJECT Monsanto Groundwater Monitoring		CHECKED MPK
	PROJECT NO. 913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE

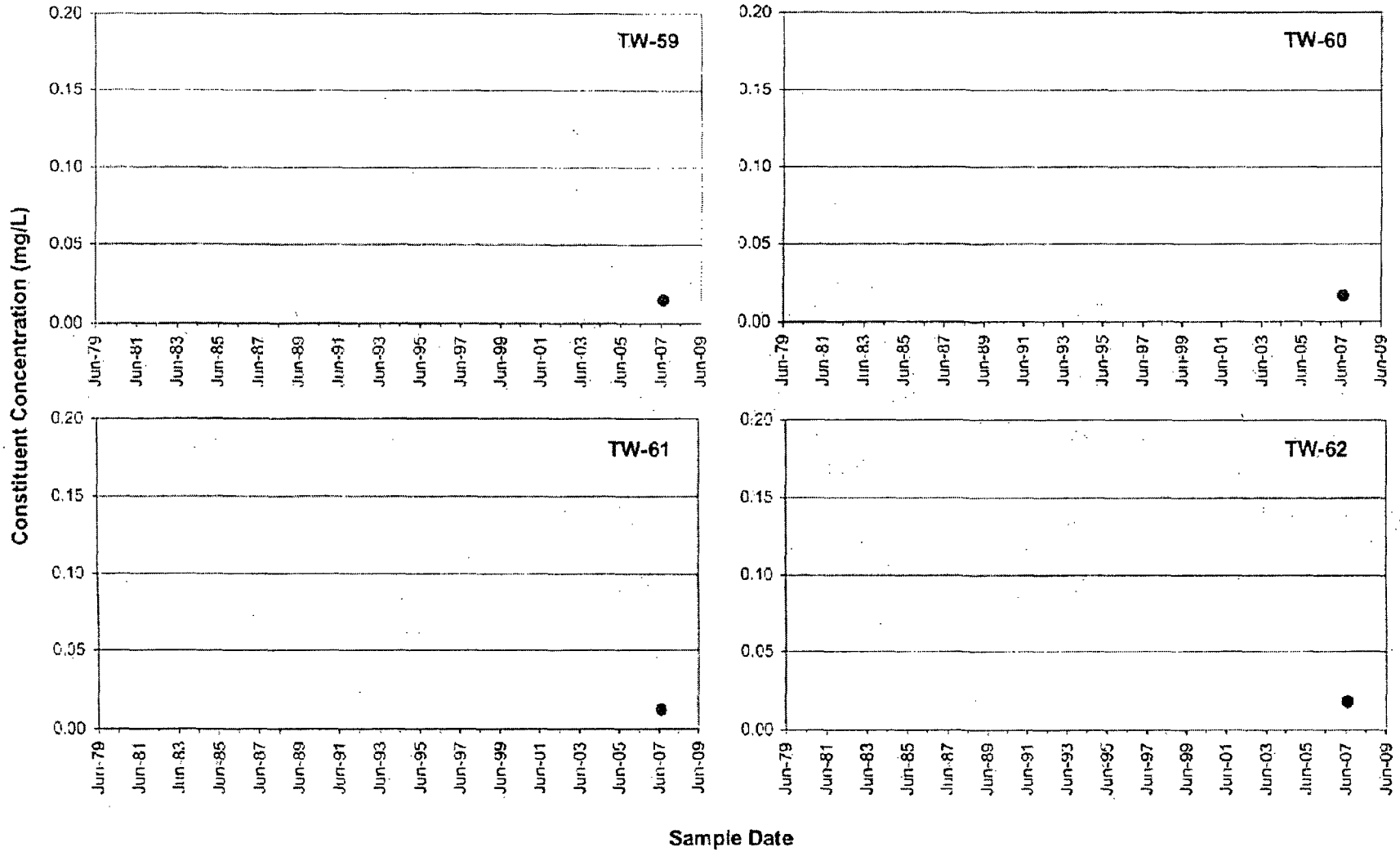
Molybdenum in Offsite Wells and Springs

FIGURE G-14

Constituent Concentration (mg/L)

Non-Detects

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO.	913-1101.605A	DATE 29-Nov-07	REVIEWED DB



FILE NAME App G Molybdenum Charts 2007.xls

Remediation goals shown for point of compliance locations only

Golder Associates

TITLE **Molybdenum in 2007 Monitoring Wells**

FIGURE G-15

Constituent Concentration (mg/L)

CLIENT	Monsanto Company	DRAWN	DH
PROJECT	Monsanto Groundwater Monitoring	CHECKED	MPK
PROJECT NO	913-1101.605A	DATE 29-Nov-07	REVIEWED DB

APPENDIX H

TIME-HISTORY GRAPHS FOR SULFATE

APPENDIX C

Sprague Environmental LLC
P.O. Box 284
Soda Springs, Idaho 83276
(208) 547-3210
(208) 547-0259 FAX

September 30, 2007

Mr. Lee Godfrey
City of Soda Springs
9 West 2nd South
Soda Springs, ID 83276

Re: Evergreen Monitor Well Sampling

Dear Lee:

The four monitor wells located on the Evergreen facility were sampled on May 28, 2007. The results of the analysis are presented in this letter.

Sampling

Each monitor wells was sampled using a clean Teflon bailer. The depth to ground water was measured and at least three casing volumes of water were removed prior to collecting the samples. When the sample bottles were filled the temperature, pH and conductivity of the ground water was measured in the field. This information was recorded on a field sampling form for each well. The samples that were analyzed for dissolved constituents were filtered in the field using a disposable 0.45 micron filter. Copies of the field sampling forms are attached. The sample bottles were sent to ACZ Laboratories in Steamboat Springs, Colorado under chain of custody for analysis.

Laboratory Analysis

The analytical results for each sample are attached. All of the analyses were completed within the EPA recommended holding times with the exception of pH. The laboratory completed the pH analysis even though the holding time had expired.

There are a few qualifications noted in the report. The data qualifiers are discussed below.

EV-1

Silver, dissolved – Recovery for either the spike or spike duplicate was outside of the acceptance limits, however, the RFD was within the acceptable limits.

Fluoride – Relative Percent Difference (RFD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

Nitrate/Nitrite as N – Relative Percent Difference (RFD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

Total suspended solids – Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

EV-2

Silver, dissolved – Recovery for either the spike or spike duplicate was outside of the acceptance limits, however, the RFD was within the acceptable limits.

Fluoride – Relative Percent Difference (RFD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

Nitrate/Nitrite as N – Relative Percent Difference (RFD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

Total suspended solids – Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

EV-3

Silver, dissolved – Recovery for either the spike or spike duplicate was outside of the acceptance limits, however, the RFD was within the acceptable limits.

Fluoride – Relative Percent Difference (RFD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

Nitrate/Nitrite as N – Relative Percent Difference (RFD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

Total suspended solids – Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

EV-4

Silver, dissolved – Recovery for either the spike or spike duplicate was outside of the acceptance limits, however, the RFD was within the acceptable limits.

Fluoride – Relative Percent Difference (RFD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

Nitrate/Nitrite as N – Relative Percent Difference (RFD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

Total suspended solids – Relative Percent Difference (RPD) was not used for data validation because the sample concentration is too low for accurate evaluation (<10X MDL).

The qualifiers discussed above do not decrease the quality of the data from the analysis of the samples collected during this sampling event. This data is usable and meets the data quality requirements of this project.

Water Quality

The locations of the monitor wells at the Evergreen site are shown in Figure 1. The ground water elevations for each monitor well are also shown. Figure 1 also shows the estimated potentiometric levels across the site.

The analytical results for each well are shown in Tables 1-8. Tables 1-4 compares the analytical results for each well to the Idaho Ground Water Quality Standard and Tables 5-8 compares the analytical results for each well to the Risk-Based Concentrations (RBC) used in the Kerr-McGee Chemical LLC CERCLA investigation. The concentration trends with time are shown in Figures 2-5. Figure 2 presents the total manganese trend, Figure 3 presents the total molybdenum trend, the total vanadium trend is shown in Figure 4 and the nitrate/nitrite concentration trend is shown in Figure 5. The water quality found in each monitor well is discussed below.

EV-1

The water quality of the water from this well for all of the sampling events is shown in Table 1 and compares the measured concentrations to the ground water quality standard. The nitrate+nitrite concentration has decreased and is currently less than the

primary drinking water standard of 10 mg/l. A possible source of nitrate+nitrite observed in this well is the agricultural field located to the north of the well. This well is not in an area within the former plant where the water could have been impacted by the operation because it is off-gradient from the processing area as shown by the potentiometric map (Figure 1). The water quality of this sample exceeds the secondary ground water quality standard for TDS. The total and dissolved concentrations of aluminum, barium and manganese were observed at concentrations smaller than the primary or secondary standard. The concentrations remaining metals that have either primary or secondary standards were smaller than the standards and the detection limit for that metal.

Table 5 compares the measured metals concentrations from the sampling events to the RBC for each metal. The constituents exceeding the RBC at EV-1 in the May 2007 sample are total and dissolved molybdenum and total and dissolved vanadium.

The total manganese concentration trend is shown on Figure 2. This trend continues to show decreasing concentrations and the total manganese concentration is smaller than the secondary ground water standard (0.05 mg/l) and the RBC (0.18 mg/l) for manganese. The total molybdenum and total vanadium concentration trends are shown in Figures 3 and 4, respectively. Both concentration trends are decreasing with time from November 2003 to September 2004 with a slight increase in the concentration of both metals from September 2004 to March 2005 and then decreasing from March 2005 to June 2006. The total molybdenum concentration has continued to decrease from June 2006 to May 2007, but the total vanadium concentration increased from June 2006 to May 2007. The nitrate+nitrite concentration has been decreasing with time since March 2005 and is shown in Figure 5.

EV-2

Table 2 compares the water quality observed in EV-2 and compares these results to the ground water quality standard. The water quality of the June 2006 sample does not exceed any of the primary ground water quality standards, but the water quality of this sample exceeds the secondary ground water quality standard for TDS and total aluminum. The dissolved aluminum concentration is smaller than the secondary ground water quality standard. The total and dissolved concentrations of the following metals that have primary or secondary ground water standards were observed at concentrations smaller than the primary or secondary standard: aluminum (dissolved only), barium, and manganese. The concentrations remaining metals that have either primary or secondary standards were smaller than the standards and the detection limit for that metal.

Table 6 compares the measured metals concentrations from the sampling events to the RBC for each metal. The constituents exceeding the RBC at EV-2 in the May 2007 sample are total and dissolved molybdenum.

The total manganese concentration trend is shown on Figure 2. This trend continues to show decreasing concentrations and the total manganese concentration is smaller than

the secondary ground water standard (0.05 mg/l) and the RBC (0.18 mg/l) for manganese. The total molybdenum and total vanadium concentration trends are shown in Figures 3 and 4, respectively. Both concentration trends are decreasing with time from November 2003 to June 2006. Figure 5 shows that the nitrate+nitrite concentration has not changed significantly with time and the concentration is less than the primary drinking water standard (10 mg/l).

EV-3

Table 3 compares the water quality observed in EV-3 and compares these results to the ground water quality standard. The water quality of the May 2007 sample does not exceed any of the primary ground water quality standards. However, the water quality of this sample exceeds the secondary ground water quality standard for pH, TDS, total aluminum and total manganese. The dissolved aluminum and manganese concentrations are smaller than the secondary ground water quality standards. The total and dissolved concentrations of the following metals that have primary or secondary ground water standards were observed at concentrations smaller than the primary or secondary standard: aluminum (dissolved only), barium, and manganese (dissolved only). The concentrations remaining metals that have either primary or secondary standards were smaller than the standards and the detection limit for that metal.

Table 7 compares the measured metals concentrations from the sampling events to the RBC for each metal. The constituents exceeding the RBC at EV-3 in the May 2007 sample are total and dissolved molybdenum.

The total manganese concentration trend is shown on Figure 2. The total manganese concentration is decreasing over time from September 2004. The total molybdenum and total vanadium concentration trends are shown in Figures 3 and 4, respectively. The total molybdenum concentration trend is decreasing with time from November 2003 to May 2007. The total vanadium concentration is decreasing with time from November 2003 to March 2005, then increases slightly from March 2005 to June 2006 and then decreases to May 2007. The nitrate+nitite concentration trend with time shown in Figure 5 indicates that the nitrate+nitrate concentration has been decreasing since March 2005 and is smaller than the primary drinking water standard of 10 mg/l.

EV-4

Table 4 presents the water quality observed in EV-4 and compares these results to the ground water quality standard. The water quality of the May 2007 sample does not exceed any of the primary ground water quality standards. The water quality of this sample exceeds the secondary ground water quality standard for TDS. The total and dissolved concentrations of aluminum, barium and manganese that have primary or secondary ground water standards were observed at small concentrations (smaller than the primary or secondary standard) or below the method detection limit. The concentrations remaining metals that have either primary or secondary standards were smaller than detection limit for that metal.

Table 8 compares the measured metals concentrations from the sampling event to the RBC for each metal. The constituents exceeding the RBC at EV-4 in the May 2007 sample are and total and dissolved molybdenum and total and dissolved vanadium. The total manganese concentration trend is shown on Figure 2. The total manganese concentration is decreasing over time from September 2004. The total molybdenum and total vanadium concentration trends are shown in Figures 3 and 4, respectively. The total molybdenum concentration trend is slightly decreasing with time from July 2004 to May 2007. The total vanadium concentration is decreasing with time from July 2004 to March 2005, then increases slightly from March 2005 to June 2006 and then decreases again to May 2007. Figure 5 shows that the nitrate+nitrite concentration has been decreasing since March 2005.

Ground Water Elevation

The ground water elevation trend for each monitor well with time is shown in Figures 6-9 and the data is shown in Tables 9-12. The ground water elevation trends with time for monitor wells EV-1 and EV-2 shown on Figures 6 and 7, respectively, are almost identical and show a recharge trend (increasing ground water elevations) from November 2003 to July 2004, then decreasing ground water elevations from July 2004 through December 2004, then a recharge trend from December 2004 to June 2006 and then decreasing ground water elevations through May 2007. The ground water elevations in EV-3 (Figure 8) and EV-4 (Figure 9) show decreasing ground water elevations from July 2004 to December 2004, then increasing ground water elevations from December 2004 to June 2006 and then decreasing ground water elevations through May 2007.

The potentiometric levels shown in Figure 1 indicate that the ground water flow direction is west to west-southwest. The ground water elevation in EV-4 is lower than expected.

Recommendations

It is recommended that this letter and the attachments be submitted to the Idaho Department of Environmental Quality (IDEQ). I am also available to discuss this information with them if you think this discussion is necessary.

A reduced analyte list is recommended and this list should be prepared and approved by IDEQ prior to the next sampling event. The propose analyte list is shown in Table 13. The following analytes are proposed to be removed from the list because they have either been detected at concentrations significantly below any standard or have not been detected while conducting the investigation: arsenic, barium, cadmium, chromium, cobalt, copper, nickel, and silver. The proposed list includes the general chemistry parameters and metals that have been detected in the past.

Thank you for the opportunity to work on this project. If you have any questions regarding this information or the sampling program, please contact me.

Sincerely,
SPRAGUE ENVIRONMENTAL LLC

Scott B. Sprague, P.E.
Principal/Owner

SBS:sbs

Attachments

Table 1

City of Soda Springs - Evergreen Facility
EV-1 Analytical Results

Constituent	Idaho Ground Water Quality Standard (mg/l)	29-Nov-03 (mg/l)	15-Jul-04 (mg/l)	29-Sep-04 (mg/l)	26-Dec-04 (mg/l)	20-Mar-05 (mg/l)	2-Jun-06 (mg/l)	28-May-07 (mg/l)
Alkalinty Bicarbonate as $CaCO_3$	-	385	402	369	412	363	381	353
Alkalinty Carbonate as $CaCO_3$	-	<2	<2	<2	<2	<2	23	<2
Total Alkalinity as CaCO3	-	385	402	369	412	363	404	353
Chloride(2)	250	62	51	51.5	50	49	56	46.9
Conductivity @ 25 C	-	1040 umhos/cm	1130 umhos/cm	1020 umhos/cm	1060 umhos/cm	1160 umhos/cm	1190 umhos/cm	1080 umhos/cm
Fluoride(1)	4	0.3	0.2	0.2	0.3	0.3	0.2	0.3
Nitrate+Nitrite(1)	10	12.4	9.5	12.5	12.3	13.5	11.6	8.87
pH(2)	6.5-8.5	8.0	7.8	7.4	7.5	7.7	8.5	8.2
TDS(2)	500	720	639	670	740	740	700	680
Sulfate(2)	250	126	110	116	113	119	147	124
Turbidity	-	770 NTU	88.9 NTU	46.6 NTU	101 NTU	59.9 NTU	2.0 NTU	1.2 NTU
Aluminum, total(2)	0.2	11.00	4.13	2.07	4.74	0.66	0.19	0.04
Aluminum, dissolved	0.2	NA	NA	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, total(1)	0.05	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic, dissolved	0.05	NA	NA	<0.04	<0.04	<0.04	<0.04	<0.04
Barium, total(1)	2	0.154	0.069	0.053	0.075	0.059	0.042	0.04
Barium, dissolved	2	NA	NA	0.034	0.039	0.036	0.041	0.038
Cadmium, total(1)	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, dissolved	0.005	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium, total	-	109	137	114	118	120	115	114
Calcium, dissolved	-	NA	NA	98.7	108	104	111	105
Chromium, total(1)	0.1	NA	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium, dissolved	0.1	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, total	-	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
Cobalt, dissolved	-	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, total(1)	1.3	0.03	0.01	<0.01	<.0.01	<0.02	<0.01	<0.01
Copper, dissolved	1.3	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium, total	-	NA	NA	39.6	41.2	41.2	40.7	39.6
Magnesium, dissolved	-	37.6	37.4	35.2	38.2	37.8	39.6	38.3
Manganese, total(2)	0.05	0.734	0.191	0.134	0.227	0.085	0.038	0.024
Manganese, dissolved	0.05	NA	NA	0.019	0.028	0.024	0.024	0.029
Molybdenum, total	-	0.92	0.74	0.73	0.75	0.76	0.71	0.66
Molybdenum, dissolved	-	NA	NA	0.72	0.74	0.70	0.68	0.65
Nickel, total	-	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel, dissolved	-	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium, total	-	NA	NA	9.2	10.3	9.3	8.4	8.1
Potassium, dissolved	-	9.1	9.2	8.1	9.0	8.6	8.2	7.6
Silver, total(2)	0.1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Silver, dissolved	0.1	NA	NA	<0.005	<0.005	<0.005	<0.01	<0.01
Sodium, total	-	NA	NA	80.9	83.9	80.1	76.4	71.6
Sodium, dissolved	-	84.5	81.7	73.7	82.3	74.5	75.9	70.3
Vanadium, total	-	1.230	1.090	1.040	1.070	1.140	0.937	0.978
Vanadium, dissolved	-	NA	NA	0.980	1.030	1.000	0.911	0.927

Shaded area indicates an exceedence of the Idaho Ground Water Quality Standard
(1) IDAPA 58.01.11 - Ground Water Quality Rule, primary standard
(2) IDAPA 58.01.11 - Ground Water Quality Rule, secondary standard

Table 2

City of Soda Springs - Evergreen Facility
EV-2 Analytical Results

Constituent	Idaho Ground Water Quality Standard (mg/l)	29-Nov-03 (mg/l)	15-Jul-04 (mg/l)	29-Sep-04 (mg/l)	26-Dec-04 (mg/l)	20-Mar-05 (mg/l)	2-Jun-06 (mg/l)	28-May-07 (mg/l)
Alkalinty Bicarbonate as $CaCO_3$	-	398	430	406	417	390	329	379
Alkalinty Carbonate as $CaCO_3$	-	<2	<2	<2	<2	<2	<2	<2
Total Alkalinity as CaCO3	-	398	430	406	417	390	329	379
Chloride(2)	250	50.4	47.1	45.6	44.8	39.0	41.2	33.9
Conductivity @ 25 C	-	862 umhos/cm	1040 umhos/cm	889 umhos/cm	884 umhos/cm	1020 umhos/cm	915 umhos/cm	928 umhos/cm
Fluoride(1)	4	0.3	0.2	0.2	0.3	0.3	0.2	0.2
Nitrate+Nitrite(1)	10	3.88	3.45	3.61	3.60	3.54	4.71	3.43
pH(2)	6.5-8.5	8.0	7.9	7.3	7.8	7.7	8.3	8.1
TDS(2)	500	620	595	590	610	600	580	580
Sulfate(2)	250	86.9	74.0	85.0	79.8	74.0	77.6	71.9
Turbidity	-	690 NTU	928 NTU	445 NTU	305 NTU	341 NTU	9.2 NTU	1.5 NTU
Aluminum, total(2)	0.2	33.00	27.10	22.6	18.3	14.2	1.59	0.63
Aluminum, dissolved	0.2	NA	NA	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, total(1)	0.05	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic, dissolved	0.05	NA	NA	<0.04	<0.04	<0.04	<0.04	<0.04
Barium, total(1)	2	0.230	0.169	0.158	0.139	0.139	0.061	0.053
Barium, dissolved	2	NA	NA	0.049	0.051	0.048	0.050	0.048
Cadmium, total(1)	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, dissolved	0.005	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium, total	-	121	137	142	129	147	111	113
Calcium, dissolved	-	NA	NA	101	107	105	105	102
Chromium, total(1)	0.1	NA	0.04	0.03	0.02	<0.05	<0.01	<0.01
Chromium, dissolved	0.1	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, total	-	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, dissolved	-	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, total(1)	1.3	0.05	0.02	0.02	0.01	0.01	<0.01	<0.01
Copper, dissolved	1.3	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium, total	-	NA	NA	56.1	51.5	58.0	43.5	43.1
Magnesium, dissolved	-	44.0	40.7	38.8	40.9	40.9	40.5	41.1
Manganese, total(2)	0.05	0.605	0.306	0.289	0.206	0.238	0.024	0.008
Manganese, dissolved	0.05	NA	NA	0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum, total	-	0.40	0.37	0.35	0.34	0.36	0.30	0.30
Molybdenum, dissolved	-	NA	NA	0.35	0.34	0.34	0.29	0.29
Nickel, total	-	0.03	0.03	0.03	0.02	0.02	<0.01	<0.01
Nickel, dissolved	-	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium, total	-	NA	NA	8.1	7.6	8.8	4.5	4.6
Potassium, dissolved	-	4.9	4.7	4.2	4.4	4.3	4.1	3.9
Silver, total(2)	0.1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Silver, dissolved	0.1	NA	NA	<0.005	<0.005	<0.005	<0.01	<0.01
Sodium, total	-	NA	NA	61.7	60.0	58.7	55.4	50.3
Sodium, dissolved	-	70.9	62.3	55.9	58.9	55.3	52.7	49.6
Vanadium, total	-	0.280	0.251	0.242	0.226	0.246	0.179	0.187
Vanadium, dissolved	-	NA	NA	0.180	0.181	0.181	0.165	0.173

Shaded area indicates an exceedence of the Idaho Ground Water Quality Standard
(1) IDAPA 58.01.11 - Ground Water Quality Rule, primary standard
(2) IDAPA 58.01.11 - Ground Water Quality Rule, secondary standard

NA - Not Analyzed

Table 3

City of Soda Springs - Evergreen Facility
EV-3 Analytical Results

Constituent	Idaho Ground Water Quality Standard (mg/l)	29-Nov-03 (mg/l)	15-Jul-04 (mg/l)	29-Sep-04 (mg/l)	26-Dec-04 (mg/l)	20-Mar-05 (mg/l)	2-Jun-06 (mg/l)	28-May-07 (mg/l)
Alkalinty Bicarbonate as $CaCO_3$	-	403	420	399	418	367	374	345
Alkalinty Carbonate as $CaCO_3$	-	<2	<2	<2	<2	<2	56	<2
Total Alkalinity as CaCO3	-	403	420	399	418	367	431	345
Chloride(2)	250	54	48.4	46.3	46.1	48.0	44.5	34.9
Conductivity @ 25 C	-	879 umhos/cm	1050 umhos/cm	900 umhos/cm	914 umhos/cm	1320 umhos/cm	1130 umhos/cm	942 umhos/cm
Fluoride(1)	4	0.3	0.2	0.2	0.3	0.3	0.2	0.2
Nitrate+Nitrite(1)	10	5.4	4.6	<0.02	6.08	25.3	6.91	5.26
pH(2)	6.5-8.5	8.1	7.8	7.2	7.7	7.7	8.6	8.2
TDS(2)	500	640	601	620	630	870	610	610
Sulfate(2)	250	88.5	79.5	89.3	87.5	131	97.9	78.3
Turbidity	-	262 NTU	65.3 NTU	165 NTU	96.3 NTU	29.9 NTU	8.3 NTU	2.4 NTU
Aluminum, total(2)	0.2	17.20	6.22	10.30	6.07	2.27	1.97	0.89
Aluminum, dissolved	0.2	NA	NA	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, total(1)	0.05	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic, dissolved	0.05	NA	NA	<0.04	<0.04	<0.04	<0.04	<0.04
Barium, total(1)	2	0.164	0.101	0.137	0.102	0.089	0.078	0.059
Barium, dissolved	2	NA	NA	0.050	0.056	0.065	0.057	0.049
Cadmium, total(1)	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, dissolved	0.005	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium, total	-	117	115	120	115	142	120	114
Calcium, dissolved	-	NA	NA	101	110	134	107	104
Chromium, total(1)	0.1	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium, dissolved	0.1	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, total	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, dissolved	-	NA	NA	<0.01	<0.01	<0.02	<0.01	<0.01
Copper, total(1)	1.3	0.02	0.02	0.01	0.01	<0.01	<0.01	<0.01
Copper, dissolved	1.3	NA	NA	<0.01	<0.01	<0.02	<0.01	<0.01
Magnesium, total	-	NA	NA	45.7	44.2	53.7	48.9	42.1
Magnesium, dissolved	-	42.4	41.1	35.5	41.9	52.5	43.1	44.2
Manganese, total(2)	0.05	0.553	0.349	0.694	0.344	0.152	0.124	0.083
Manganese, dissolved	0.05	NA	NA	0.025	0.016	0.016	0.011	0.016
Molybdenum, total	-	0.44	0.37	0.36	0.35	0.36	0.34	0.31
Molybdenum, dissolved	-	NA	NA	0.35	0.35	0.34	0.33	0.3
Nickel, total	-	0.05	0.04	0.05	0.03	0.03	0.03	0.02
Nickel, dissolved	-	NA	NA	0.02	0.02	0.02	0.02	0.02
Potassium, total	-	NA	NA	6.1	5.7	5.5	6.7	4.6
Potassium, dissolved	-	5.0	5.3	4.4	4.6	4.8	5.9	4.4
Silver, total(2)	0.1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Silver, dissolved	0.1	NA	NA	<0.005	<0.005	<0.005	<0.01	<0.01
Sodium, total	-	NA	NA	64.1	63.1	69.7	66.4	52.9
Sodium, dissolved	-	72.8	65.3	56.4	61.7	66.1	60.5	51.8
Vanadium, total	-	0.227	0.196	0.216	0.195	0.181	0.352	0.257
Vanadium, dissolved	-	NA	NA	0.159	0.165	0.158	0.325	0.234

Shaded area indicates an exceedence of the Idaho Ground Water Quality Standard
(1) IDAPA 58.01.11 - Ground Water Quality Rule, primary standard
(2) IDAPA 58.01.11 - Ground Water Quality Rule, secondary standard

NA - Not Analyzed

Table 4

City of Soda Springs - Evergreen Facility
EV-4 Analytical Results

Constituent	Idaho Ground Water Quality Standard (mg/l)	29-Nov-03 (mg/l)	15-Jul-04 (mg/l)	29-Sep-04 (mg/l)	26-Dec-04 (mg/l)	20-Mar-05 (mg/l)	2-Jun-06 (mg/l)	28-May-07 (mg/l)
Alkalinty Bicarbonate as $CaCO_3$	-	Not Sampled	427	402	385	373	378	374
Alkalinty Carbonate as $CaCO_3$	-	Well Not Drilled	<2	<2	<2	<2	28	<2
Total Alkalinity as CaCO3	-		427	402	385	373	407	374
Chloride(2)	250		50.0	52.8	46.0	51.0	53.2	41.2
Conductivity @ 25 C	-		1130 umhos/cm	1010 umhos/cm	993 umhos/cm	1220 umhos/cm	1060 umhos/cm	1020 umhos/cm
Fluoride(1)	4		0.2	0.2	0.3	0.3	0.2	0.2
Nitrate+Nitrite(1)	10		5.6	6.68	8.18	15.2	13.1	6.91
pH(2)	6.5-8.5		7.8	7.2	7.6	7.7	8.5	8.2
TDS(2)	500		639	660	680	750	710	650
Sulfate(2)	250		97.9	113	111	107	133	99.8
Turbidity	-		8.5 NTU	3.1 NTU	1.4 NTU	0.8 NTU	0.5 NTU	1.9 NTU
Aluminum, total(2)	0.2		1.89	0.36	0.06	0.08	0.04	<0.03
Aluminum, dissolved	0.2		NA	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, total(1)	0.05		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic, dissolved	0.05		NA	<0.04	<0.04	<0.04	<0.04	<0.04
Barium, total(1)	2		0.066	0.049	0.048	0.052	0.050	0.049
Barium, dissolved	2		NA	0.045	0.049	0.049	0.046	0.047
Cadmium, total(1)	0.005		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, dissolved	0.005		NA	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium, total	-		115	113	115	123	127	120
Calcium, dissolved	-		NA	107	112	116	114	108
Chromium, total(1)	0.1		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium, dissolved	0.1		NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, total	-		<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
Cobalt, dissolved	-		NA	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, total(1)	1.3		0.02	<0.01	<0.01	<0.02	<0.01	<0.01
Copper, dissolved	1.3		NA	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium, total	-		NA	42.8	43.5	46.4	48.7	43.6
Magnesium, dissolved	-		41.6	40.6	42.5	45.6	44.0	41.5
Manganese, total(2)	0.05		0.045	0.025	0.019	0.017	0.025	0.017
Manganese, dissolved	0.05		NA	0.016	0.017	0.015	0.022	0.022
Molybdenum, total	-		0.49	0.47	0.47	0.47	0.48	0.44
Molybdenum, dissolved	-		NA	0.46	0.46	0.45	0.45	0.41
Nickel, total	-		0.02	0.01	0.01	0.02	0.01	0.01
Nickel, dissolved	-		NA	0.01	<0.01	0.01	0.01	<0.01
Potassium, total	-		NA	5.9	6.3	6.3	7.0	5.8
Potassium, dissolved	-		6.3	5.7	6.0	6.2	6.6	5.5
Silver, total(2)	0.1		<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Silver, dissolved	0.1		NA	<0.005	<0.005	<0.005	<0.01	<0.01
Sodium, total	-		NA	73.5	74.4	75.7	76.9	62.9
Sodium, dissolved	-		75.7	67.8	71.8	70.7	71.8	60.8
Vanadium, total	-		0.352	0.333	0.334	0.331	0.499	0.41
Vanadium, dissolved	-		NA	0.320	0.324	0.316	0.488	0.385

Shaded area indicates an exceedence of the Idaho Ground Water Quality Standard
(1) IDAPA 58.01.11 - Ground Water Quality Rule, primary standard
(2) IDAPA 58.01.11 - Ground Water Quality Rule, secondary standard

NA - Not Analyzed

Table 5

City of Soda Springs - Evergreen Facility
EV-1 Analytical Results

Constituent	Risk-Based Concentration[1] (mg/l)	29-Nov-03 (mg/l)	15-Jul-04 (mg/l)	29-Sep-04 (mg/l)	26-Dec-04 (mg/l)	20-Mar-05 (mg/l)	2-Jun-06 (mg/l)	28-May-07 (mg/l)
Aluminum, total	36	11.00	4.13	2.07	4.74	0.66	0.19	0.04
Aluminum, dissolved	36	NA	NA	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, total	0.011	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic, dissolved	0.011	NA	NA	<0.04	<0.04	<0.04	<0.04	<0.04
Barium, total	2.6	0.154	0.069	0.053	0.075	0.059	0.042	0.04
Barium, dissolved	2.6	NA	NA	0.034	0.039	0.036	0.041	0.038
Cadmium, total	0.019	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, dissolved	0.019	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium, total	0.36	NA	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium, dissolved	0.36	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, total	0.91	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
Cobalt, dissolved	0.91	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, total	1.4	0.03	0.01	<0.01	<.0.01	<0.02	<0.01	<0.01
Copper, dissolved	1.4	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese, total	0.18	0.734	0.191	0.134	0.227	0.085	0.038	0.024
Manganese, dissolved	0.18	NA	NA	0.019	0.028	0.024	0.024	0.029
Molybdenum, total	0.18	0.92	0.74	0.73	0.75	0.76	0.71	0.66
Molybdenum, dissolved	0.18	NA	NA	0.72	0.74	0.70	0.68	0.65
Nickel, total	0.73	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel, dissolved	0.73	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Silver, total	0.18	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Silver, dissolved	0.18	NA	NA	<0.005	<0.005	<0.005	<0.01	<0.01
Vanadium, total	0.26	1.230	1.090	1.040	1.070	1.140	0.937	0.978
Vanadium, dissolved	0.26	NA	NA	0.980	1.030	1.000	0.911	0.927

Shaded area indicates an exceedence of the risk-based concentration
(1) SAIC; Draft Human Health and Ecological Risk Assessments for Kerr-McGee Chemical Corporation; Soda Springs, Idaho; October 1993.

NA - Not Analyzed

Table 6

City of Soda Springs - Evergreen Facility
EV-2 Analytical Results

Constituent	Risk-Based Concentration[1] (mg/l)	29-Nov-03 (mg/l)	15-Jul-04 (mg/l)	29-Sep-04 (mg/l)	26-Dec-04 (mg/l)	20-Mar-05 (mg/l)	2-Jun-06 (mg/l)	28-May-07 (mg/l)
Aluminum, total	36	33.00	27.10	22.6	18.3	14.2	1.59	0.63
Aluminum, dissolved	36	NA	NA	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, total	0.011	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic, dissolved	0.011	NA	NA	<0.04	<0.04	<0.04	<0.04	<0.04
Barium, total	2.6	0.230	0.169	0.158	0.139	0.139	0.061	0.053
Barium, dissolved	2.6	NA	NA	0.049	0.051	0.048	0.050	0.048
Cadmium, total	0.019	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, dissolved	0.019	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium, total	0.36	NA	0.04	0.03	0.02	<0.05	<0.01	<0.01
Chromium, dissolved	0.36	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, total	0.91	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, dissolved	0.91	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, total	1.4	0.05	0.02	0.02	0.01	0.01	<0.01	<0.01
Copper, dissolved	1.4	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese, total	0.18	0.605	0.306	0.289	0.206	0.238	0.024	0.008
Manganese, dissolved	0.18	NA	NA	0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum, total	0.18	0.40	0.37	0.35	0.34	0.36	0.30	0.30
Molybdenum, dissolved	0.18	NA	NA	0.35	0.34	0.34	0.29	0.29
Nickel, total	0.73	0.03	0.03	0.03	0.02	0.02	<0.01	<0.01
Nickel, dissolved	0.73	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Silver, total	0.18	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Silver, dissolved	0.18	NA	NA	<0.005	<0.005	<0.005	<0.01	<0.01
Vanadium, total	0.26	0.280	0.251	0.242	0.226	0.246	0.179	0.187
Vanadium, dissolved	0.26	NA	NA	0.180	0.181	0.181	0.165	0.173

Shaded area indicates an exceedence of the rick-based concentration
(1) SAIC; Draft Human Health and Ecological Risk Assessments for Kerr-McGee Chemical Corporation; Soda Springs, Idaho; October 1993.

NA - Not Analyzed

Table 7

City of Soda Springs - Evergreen Facility
EV-3 Analytical Results

Constituent	Risk-Based Concentration[1] (mg/l)	29-Nov-03 (mg/l)	15-Jul-04 (mg/l)	29-Sep-04 (mg/l)	26-Dec-04 (mg/l)	20-Mar-05 (mg/l)	2-Jun-06 (mg/l)	28-May-07 (mg/l)
Aluminum, total	36	17.20	6.22	10.30	6.07	2.27	1.97	0.89
Aluminum, dissolved	36	NA	NA	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, total	0.011	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic, dissolved	0.011	NA	NA	<0.04	<0.04	<0.04	<0.04	<0.04
Barium, total	2.6	0.164	0.101	0.137	0.102	0.089	0.078	0.059
Barium, dissolved	2.6	NA	NA	0.050	0.056	0.065	0.057	0.049
Cadmium, total	0.019	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, dissolved	0.019	NA	NA	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium, total	0.36	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium, dissolved	0.36	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, total	0.91	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
Cobalt, dissolved	0.91	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, total	1.4	0.02	0.02	0.01	0.01	<0.02	<0.01	<0.01
Copper, dissolved	1.4	NA	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese, total	0.18	0.553	0.349	0.694	0.344	0.152	0.124	0.063
Manganese, dissolved	0.18	NA	NA	0.025	0.016	0.016	0.011	0.016
Molybdenum, total	0.18	0.44	0.37	0.36	0.35	0.36	0.34	0.31
Molybdenum, dissolved	0.18	NA	NA	0.35	0.35	0.34	0.33	0.30
Nickel, total	0.73	0.05	0.04	0.05	0.03	0.03	0.03	0.02
Nickel, dissolved	0.73	NA	NA	0.02	0.02	0.02	0.02	0.02
Silver, total	0.18	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Silver, dissolved	0.18	NA	NA	<0.005	<0.005	<0.005	<0.01	<0.01
Vanadium, total	0.26	0.227	0.196	0.216	0.195	0.181	0.352	0.257
Vanadium, dissolved	0.26	NA	NA	0.159	0.165	0.158	0.325	0.234

Shaded area indicates an exceedence of the risk=based concentration
(1) SAIC; Draft Human Health and Ecological Risk Assessments for Kerr-McGee Chemical Corporation; Soda Springs, Idaho; October 1993.

NA - Not Analyzed

Table 8

City of Soda Springs - Evergreen Facility
EV-4 Analytical Results

Constituent	Risk-Based Concentration[1] (mg/l)	29-Nov-03 (mg/l)	15-Jul-04 (mg/l)	29-Sep-04 (mg/l)	26-Dec-04 (mg/l)	20-Mar-05 (mg/l)	2-Jun-06 (mg/l)	28-May-07 (mg/l)
Aluminum, total	36	Not Sampled	1.89	0.36	0.06	0.08	0.04	<0.03
Aluminum, dissolved	36	Well Not	NA	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, total	0.011	Drilled	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Arsenic, dissolved	0.011		NA	<0.04	<0.04	<0.04	<0.04	<0.04
Barium, total	2.6		0.066	0.049	0.048	0.052	0.050	0.049
Barium, dissolved	2.6		NA	0.045	0.049	0.049	0.046	0.047
Cadmium, total	0.019		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium, dissolved	0.019		NA	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium, total	0.36		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium, dissolved	0.36		NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt, total	0.91		<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
Cobalt, dissolved	0.91		NA	<0.01	<0.01	<0.01	<0.01	<0.01
Copper, total	1.4		0.02	<0.01	<0.01	<0.02	<0.01	<0.01
Copper, dissolved	1.4		NA	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese, total	0.18		0.045	0.025	0.019	0.017	0.025	0.017
Manganese, dissolved	0.18		NA	0.016	0.017	0.015	0.022	0.022
Molybdenum, total	0.18		0.49	0.47	0.47	0.47	0.47	0.44
Molybdenum, dissolved	0.18		NA	0.46	0.46	0.45	0.45	0.41
Nickel, total	0.73		0.02	0.01	0.01	0.02	0.01	0.01
Nickel, dissolved	0.73		NA	0.01	<0.01	0.01	0.01	<0.01
Silver, total	0.18		<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Silver, dissolved	0.18		NA	<0.005	<0.005	<0.005	<0.01	<0.01
Vanadium, total	0.26		0.352	0.333	0.334	0.331	0.499	0.41
Vanadium, dissolved	0.26		NA	0.320	0.324	0.316	0.488	0.385

Shaded area indicates an exceedence of the risk-based concentration
(1) SAIC; Draft Human Health and Ecological Risk Assessments for Kerr-McGee Chemical Corporation; Soda Springs, Idaho; October 1993.

NA - Not Analyzed

Table 9

City of Soda Springs - Evergreen Facility
EV-1 Ground Water Elevation

Top of Casing Elevation (ft MSL): 5,951.00

Date	Depth to Water (ft)	Ground Water Elevation (ft MSL)
29-Nov-03	21.45	5,929.55
15-Jul-04	21.12	5,929.88
29-Sep-04	22.14	5,928.86
26-Dec-04	22.28	5,928.72
20-Mar-05	20.62	5,930.38
2-Jun-06	19.11	5,931.89
28-May-07	20.22	5,930.78

Table 10

City of Soda Springs - Evergreen Facility
EV-2 Ground Water Elevation

Top of Casing Elevation (ft MSL): 5,943.00

Date	Depth to Water (ft)	Ground Water Elevation (ft MSL)
29-Nov-03	13.83	5,929.17
15-Jul-04	13.63	5,929.37
29-Sep-04	14.13	5,928.87
26-Dec-04	14.22	5,928.78
20-Mar-05	12.98	5,930.02
2-Jun-06	12.01	5,930.99
28-May-07	12.53	5,930.47

Table 11

City of Soda Springs - Evergreen Facility
EV-3 Ground Water Elevation

Top of Casing Elevation (ft MSL): 5,938.00

Date	Depth to Water (ft)	Ground Water Elevation (ft MSL)
15-Jul-04	22.09	5,915.91
29-Sep-04	24.02	5,913.98
26-Dec-04	24.56	5,913.44
20-Mar-05	20.57	5,917.43
2-Jun-06	18.53	5,919.47
28-May-07	19.84	5,918.16

Table 12

City of Soda Springs - Evergreen Facility
EV-4 Ground Water Elevation

Top of Casing Elevation (ft MSL): 5,945.00

Date	Depth to Water (ft)	Ground Water Elevation (ft MSL)
15-Jul-04	43.76	5,901.24
29-Sep-04	44.79	5,900.21
26-Dec-04	44.86	5,900.14
20-Mar-05	42.79	5,902.21
2-Jun-06	41.08	5,903.92
28-May-07	42.07	5,902.93

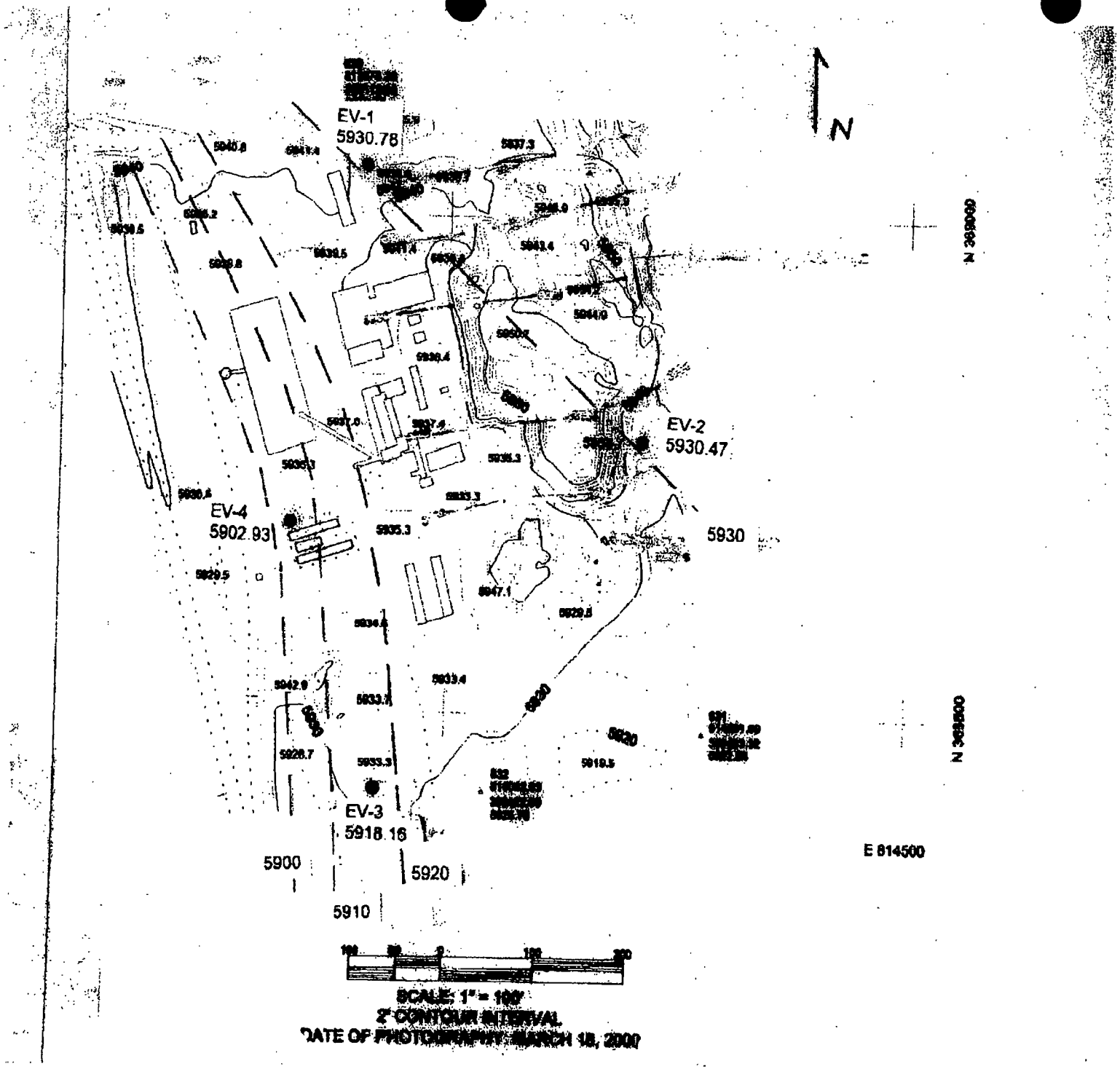


Figure 1
Site and Photogrammetric Map

Figure 2

Total Manganese Concentration Trend

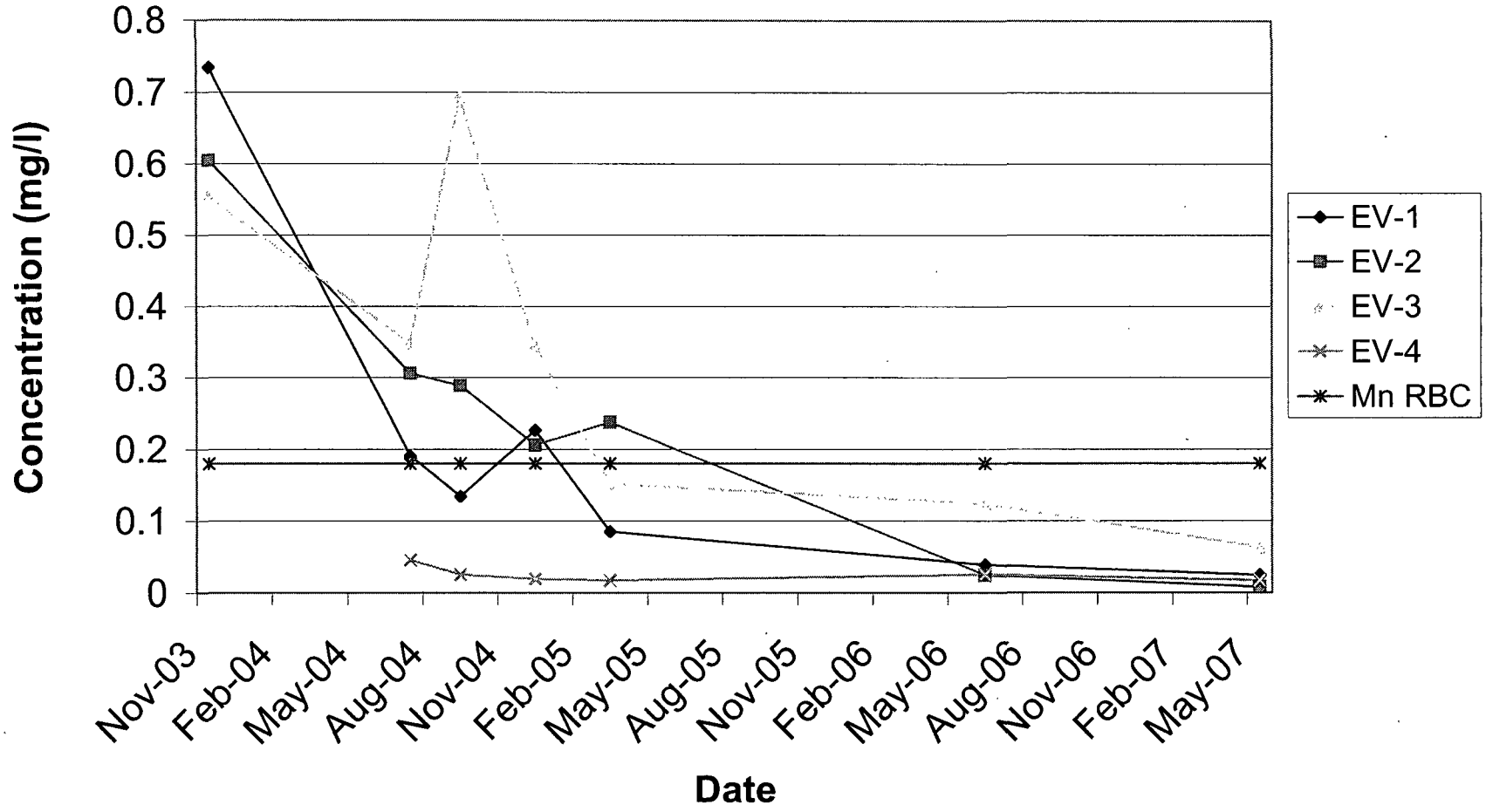


Figure 2

Total Manganese Concentration Trend

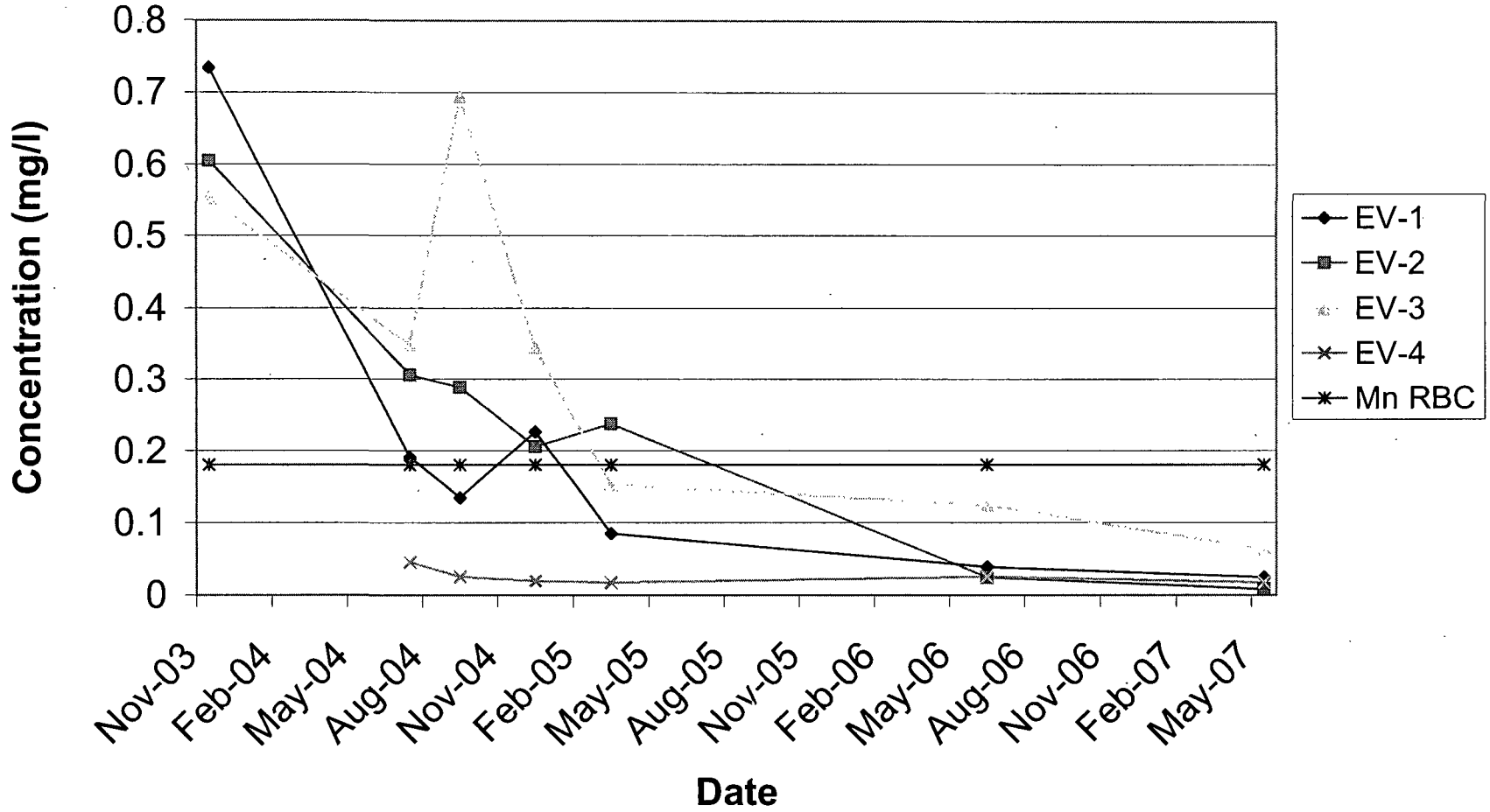


Figure 3

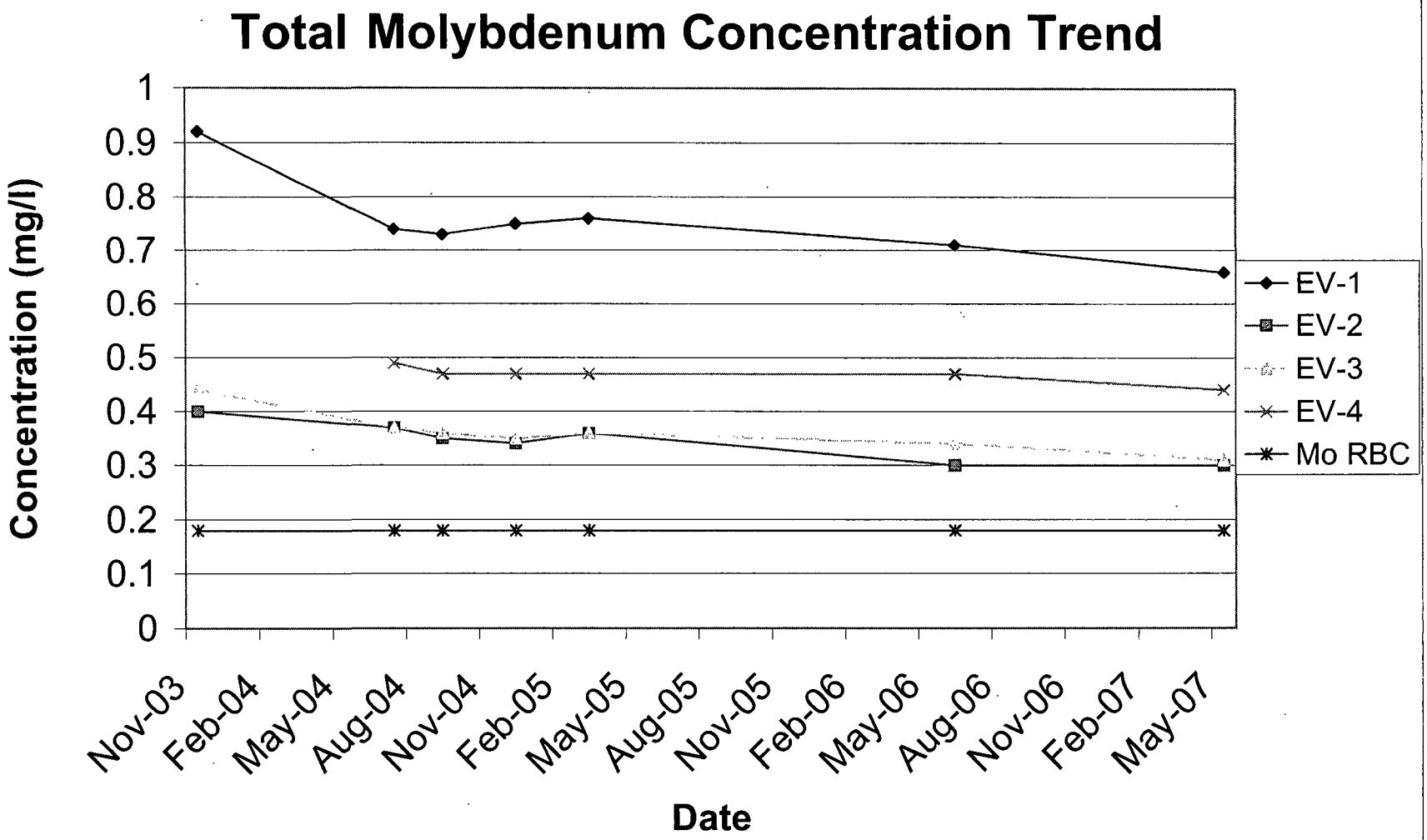

Total Molybdenum Concentration Trend
Concentration (mg/l)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Nov-03
Feb-04
May-04
Aug-04
Nov-04
Feb-05
May-05
Aug-05
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Date
EV-1
EV-2
EV-3
EV-4
Mo RBC

Figure 4

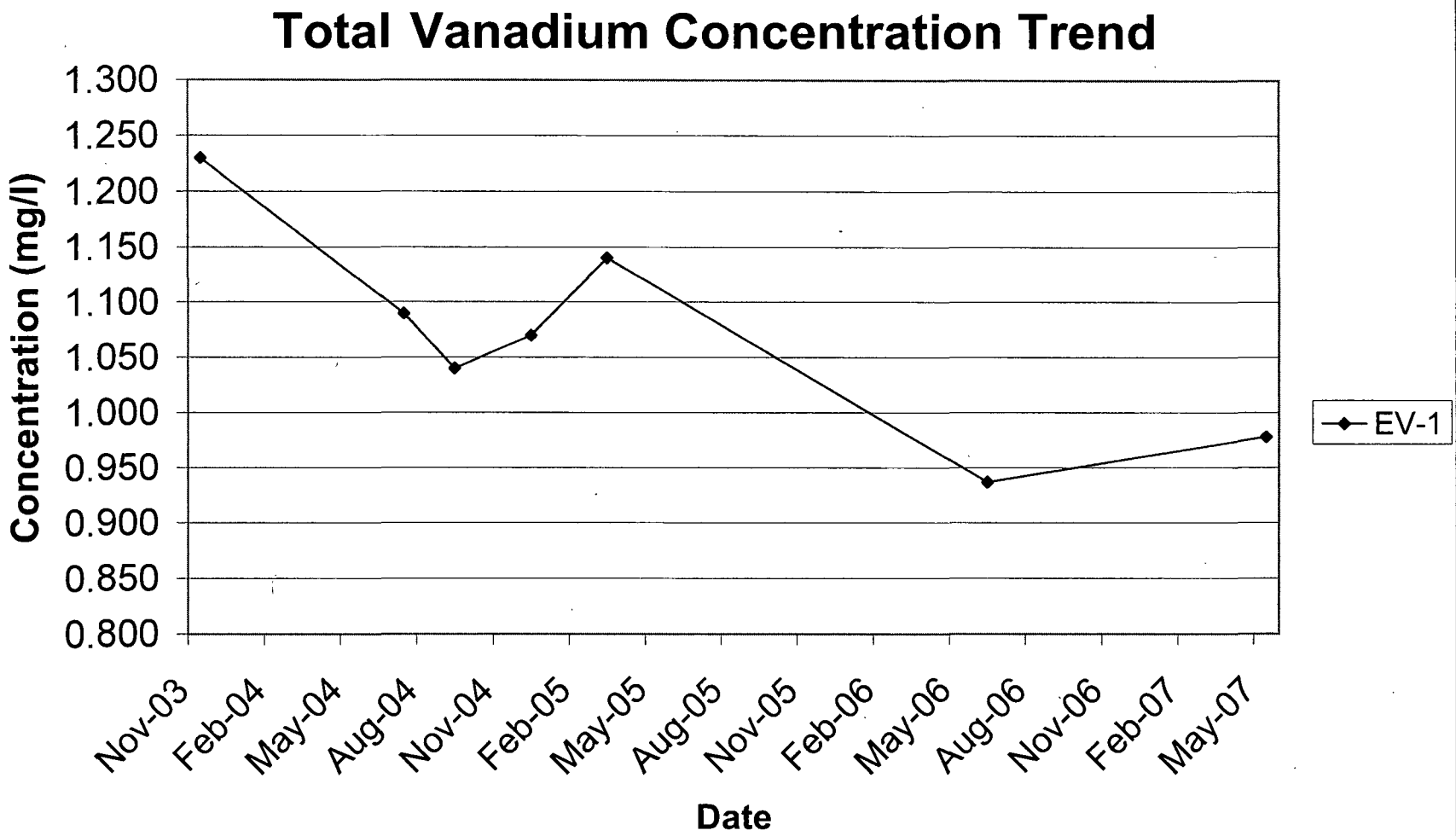

Total Vanadium Concentration Trend
Concentration (mg/l)
1.300
1.250
1.200
1.150
1.100
1.050
1.000
0.950
0.900
0.850
0.800
Nov-03
Feb-04
May-04
Aug-04
Nov-04
Feb-05
May-05
Aug-05
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Date
EV-1

Figure 4

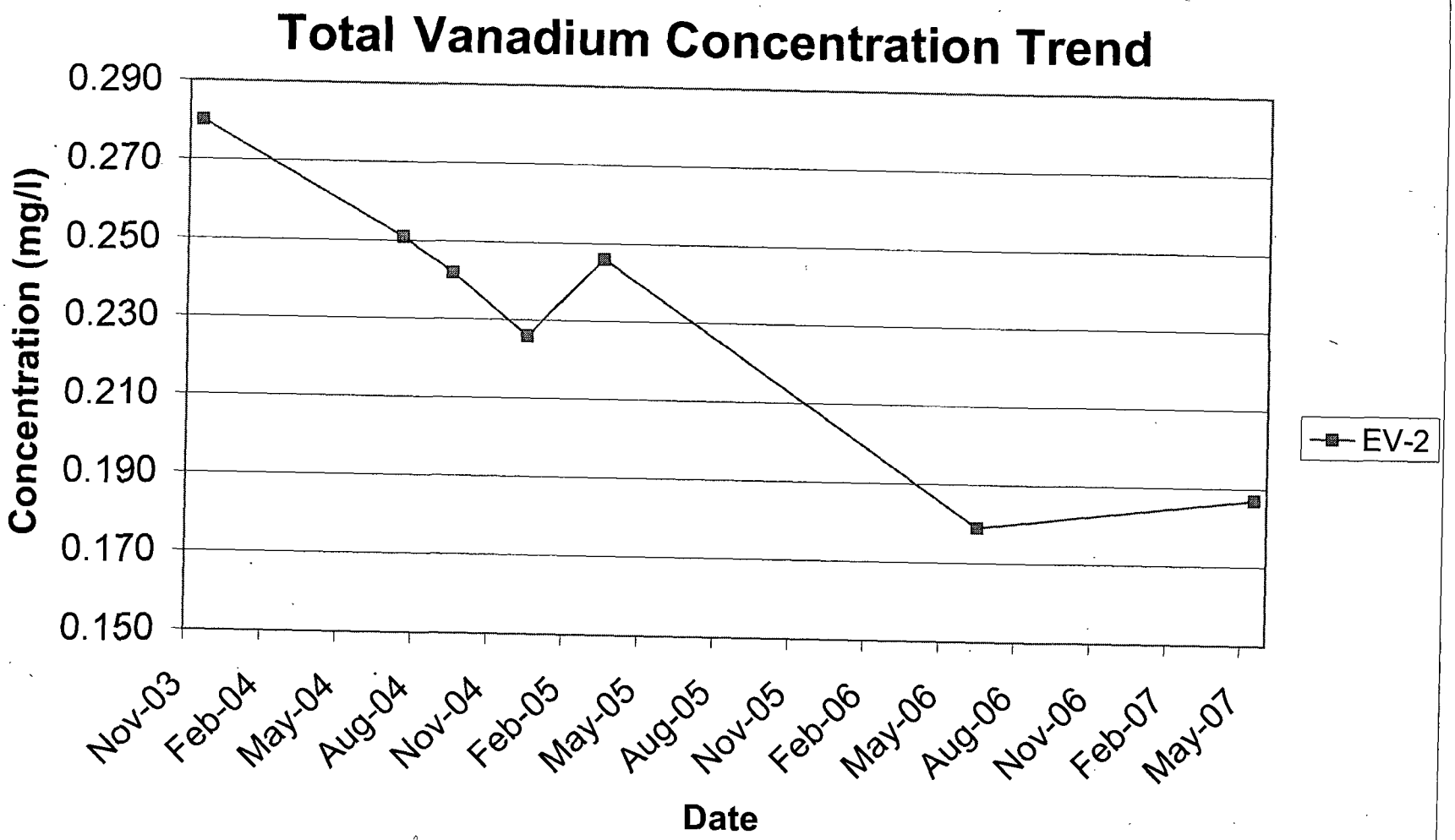

Total Vanadium Concentration Trend
Concentration (mg/l)
0.290
0.270
0.250
0.230
0.210
0.190
0.170
0.150
Nov-03
Feb-04
May-04
Aug-04
Nov-04
Feb-05
May-05
Aug-05
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Date
EV-2

Figure 4

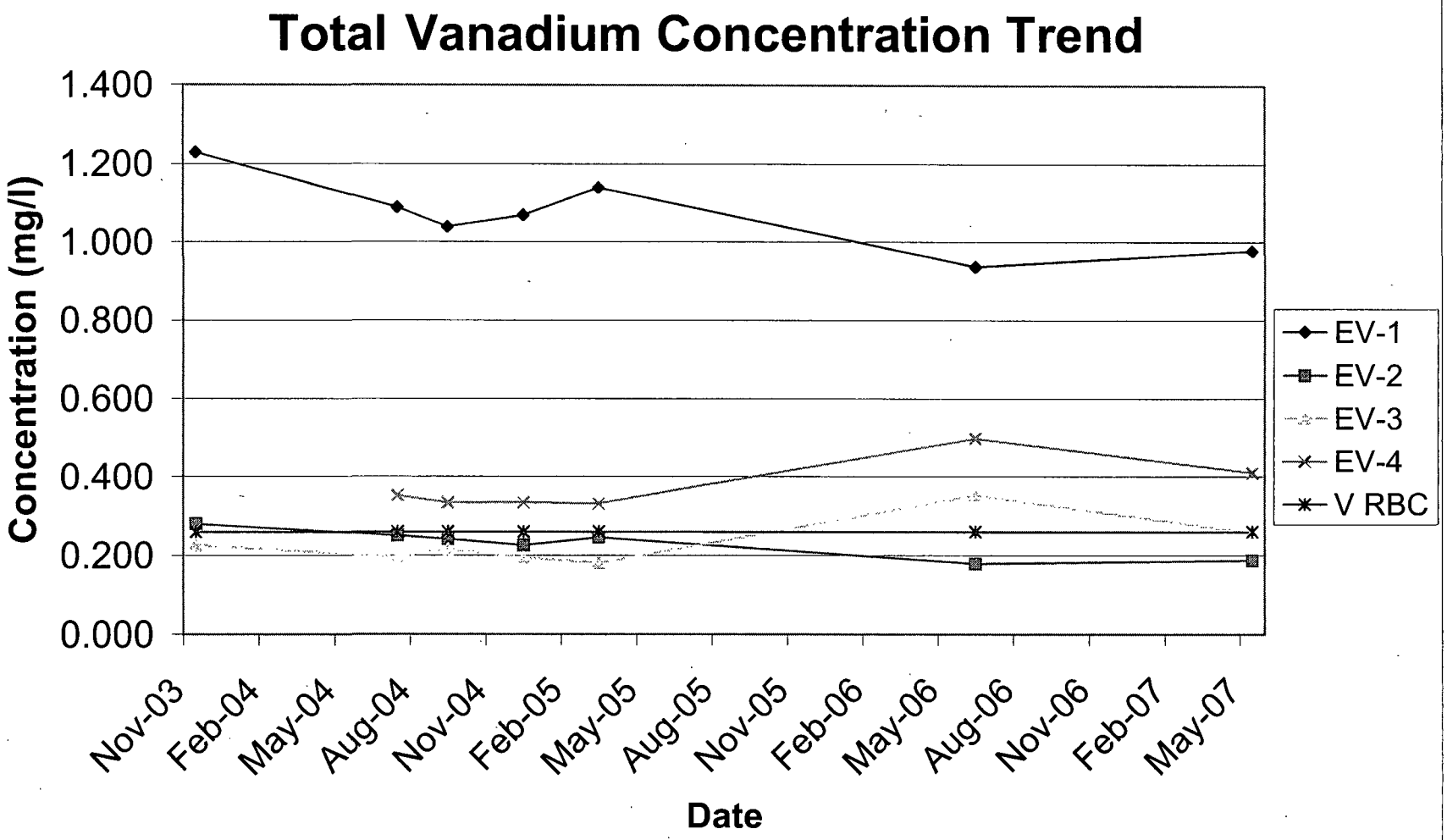

Total Vanadium Concentration Trend
Concentration (mg/l)
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Nov-03
Feb-04
May-04
Aug-04
Nov-04
Feb-05
May-05
Aug-05
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Date
EV-1
EV-2
EV-3
EV-4
V RBC

Figure 5

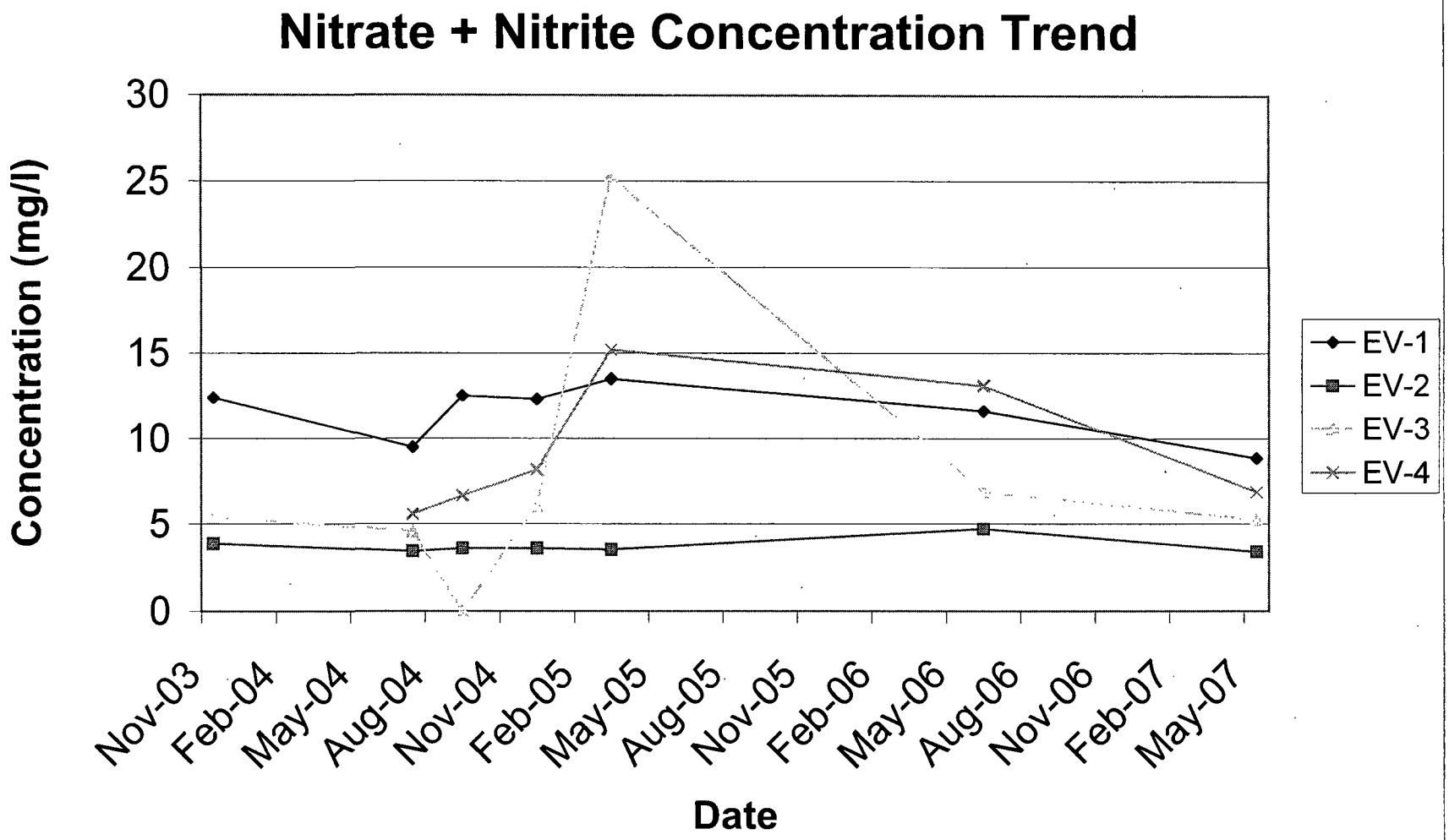

Nitrate + Nitrite Concentration Trend
Concentration (mg/l)
30
25
20
15
10
5
0
Nov-03
Feb-04
May-04
Aug-04
Nov-04
Feb-05
May-05
Aug-05
Nov-05
Feb-06
May-06
Aug-06
Nov-06
Feb-07
May-07
Date
EV-1
EV-2
EV-3
EV-4

Figure 6

EV-1 Ground Water Elevation

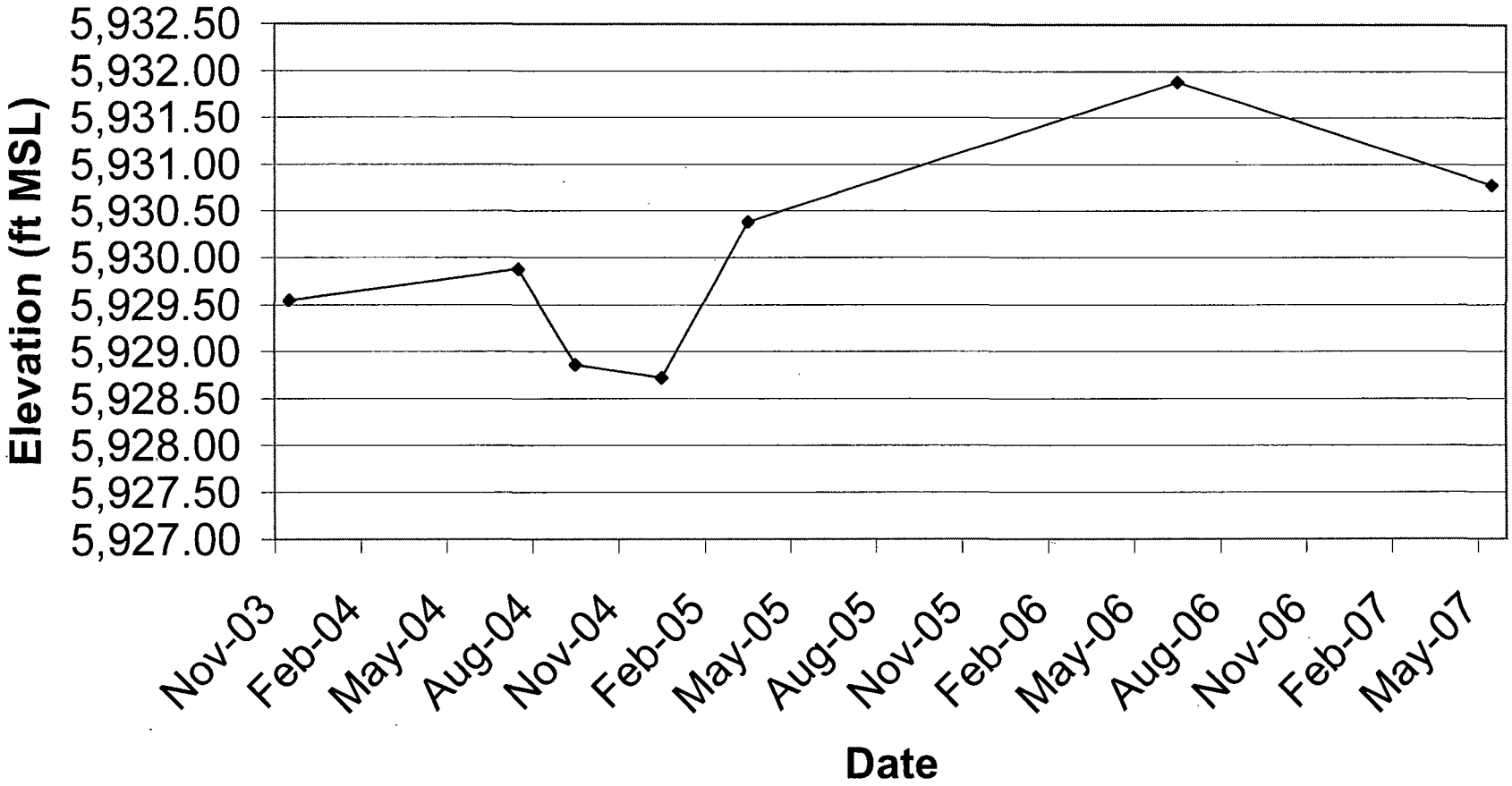


Figure 7
EV-2 Ground Water Elevation

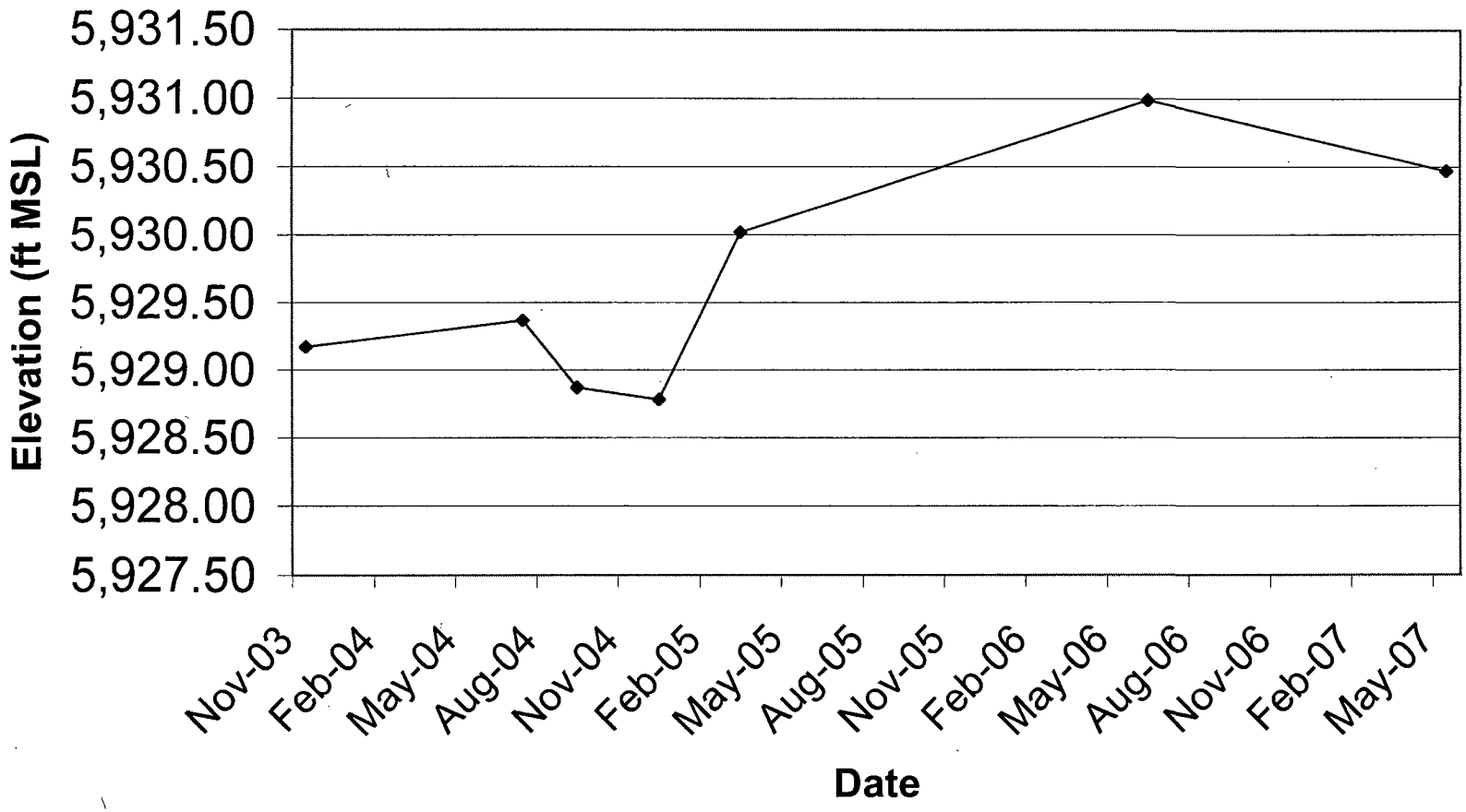


Figure 8

EV-3 Ground Water Elevation

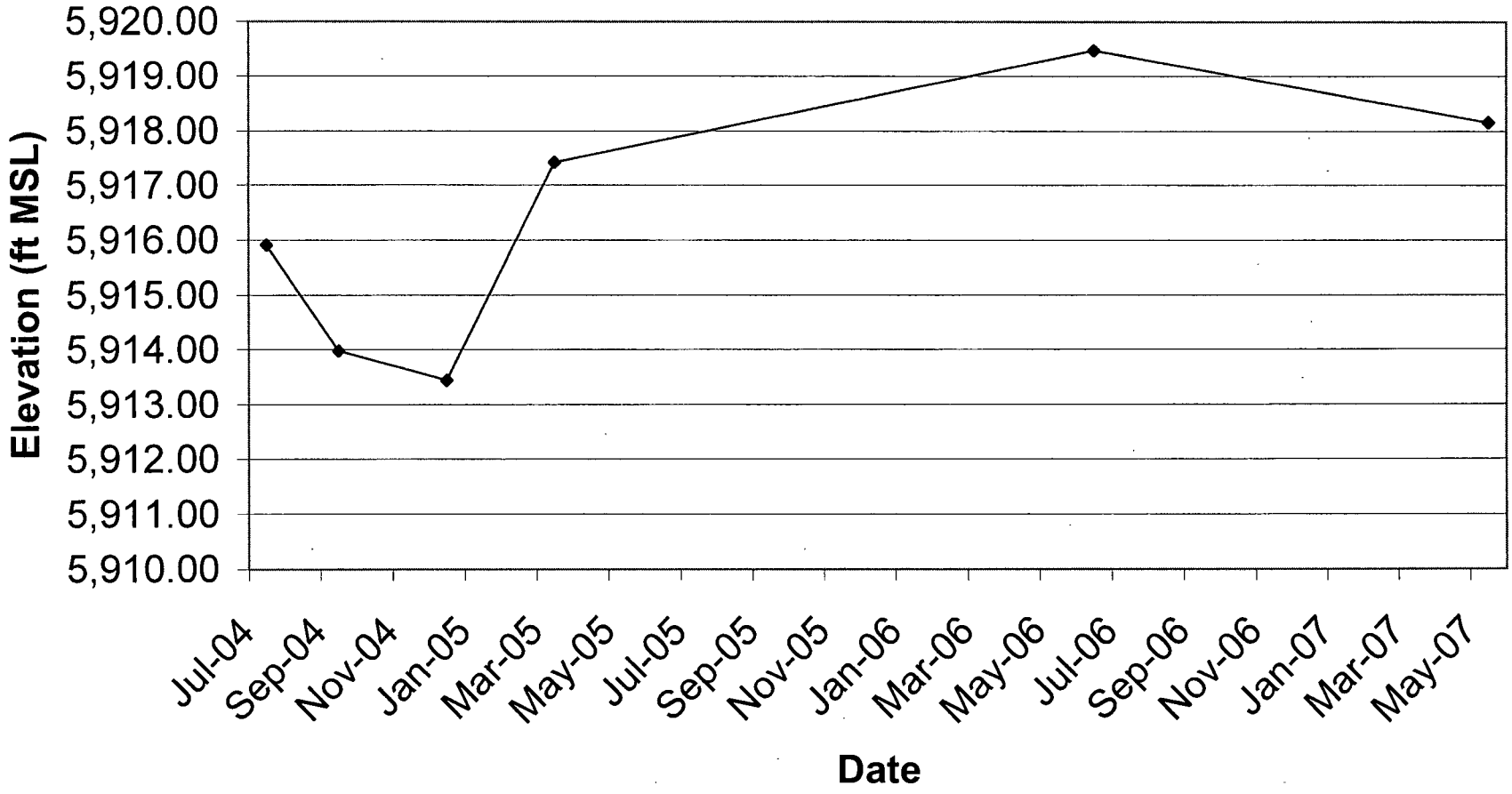
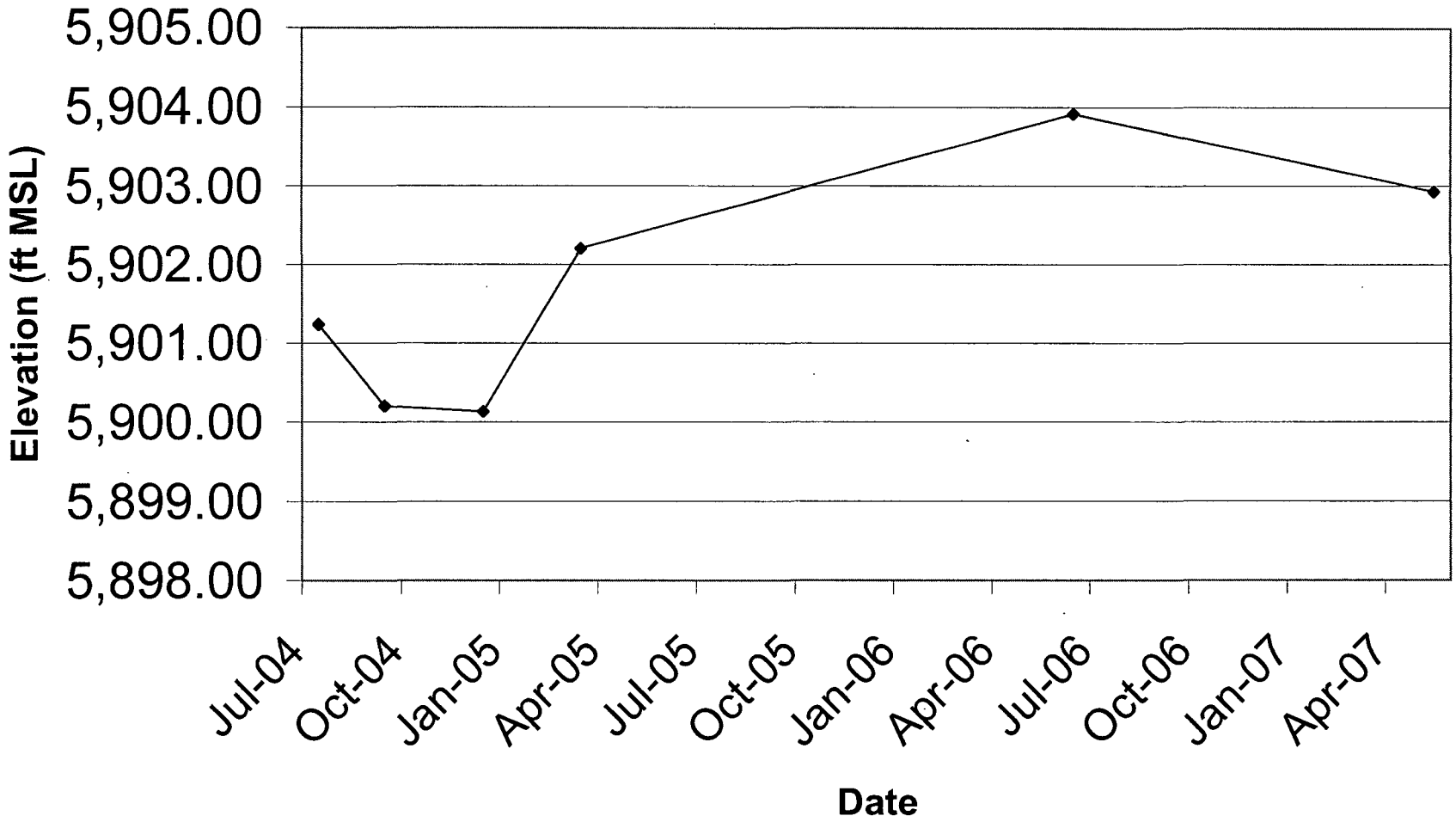
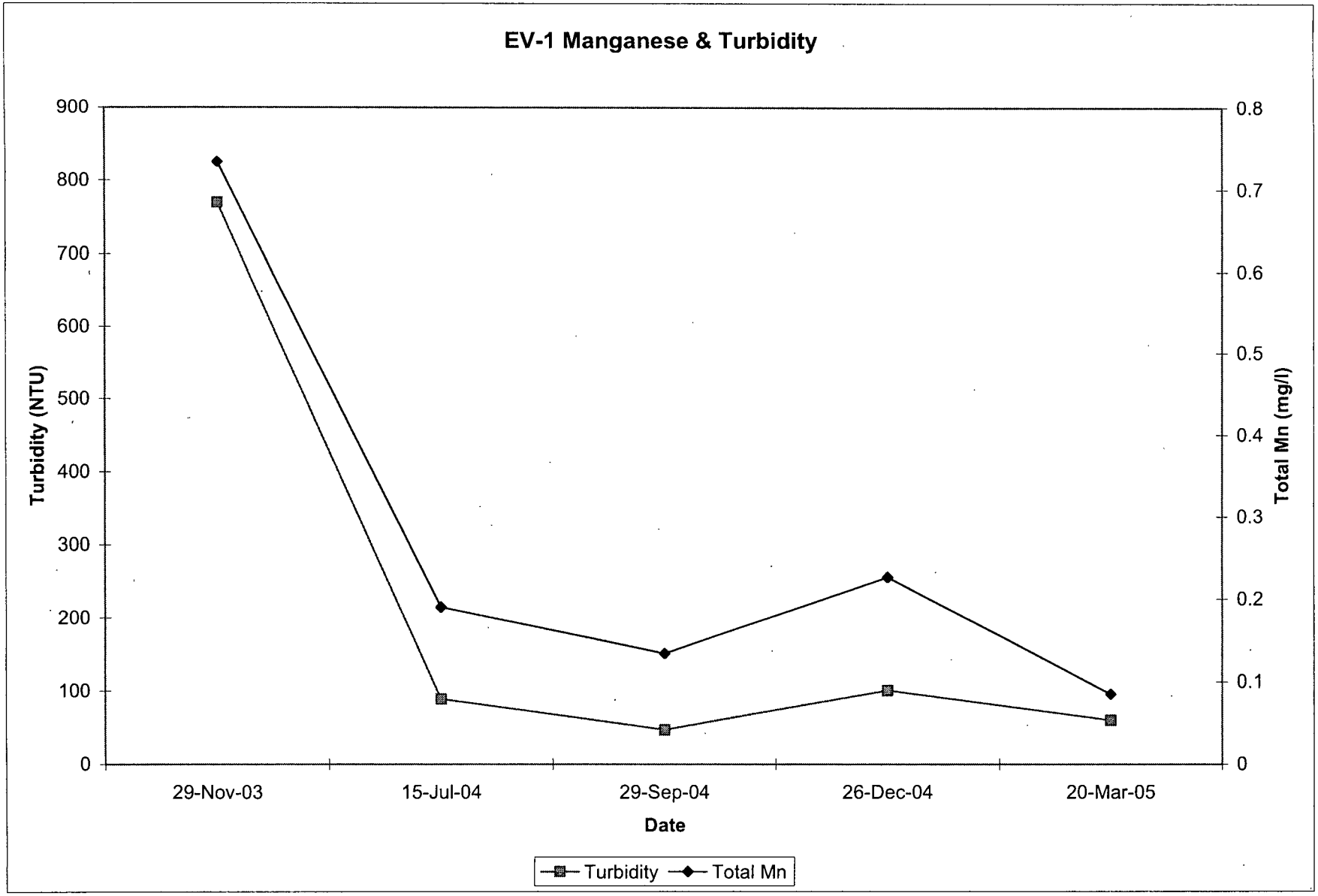


Figure 9

EV-4 Ground Water Elevation




EV-1 Manganese & Turbidity
Turbidity (NTU)
900
800
700
600
500
400
300
200
100
0
Total Mn (mg/l)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
29-Nov-03
15-Jul-04
29-Sep-04
26-Dec-04
20-Mar-05
Date
Turbidity
Total Mn